

MODERN Machine Shop

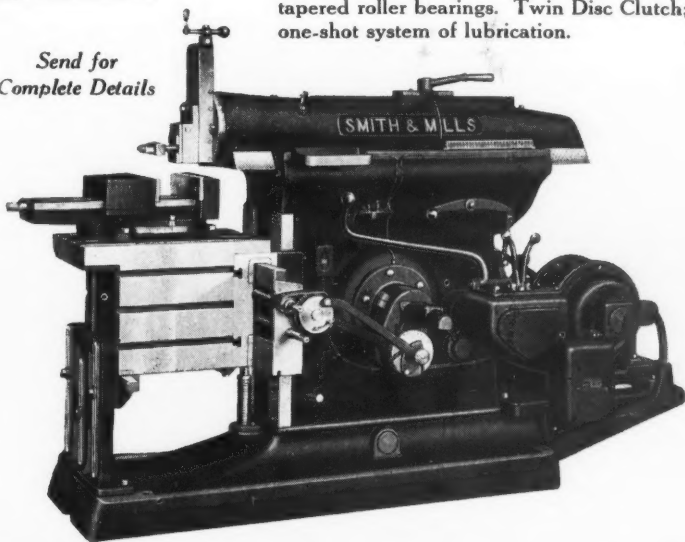
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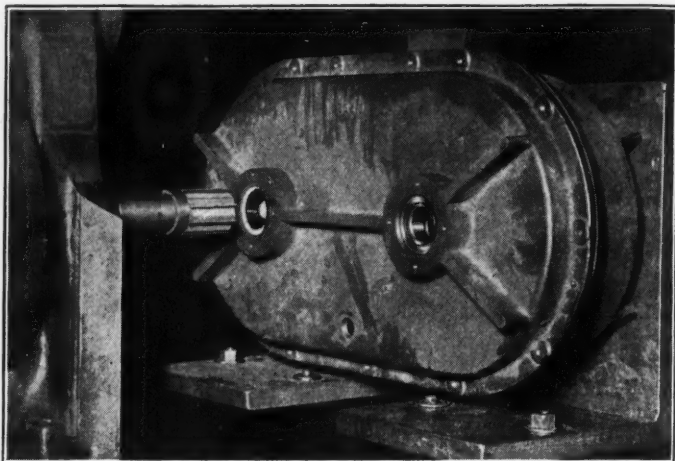
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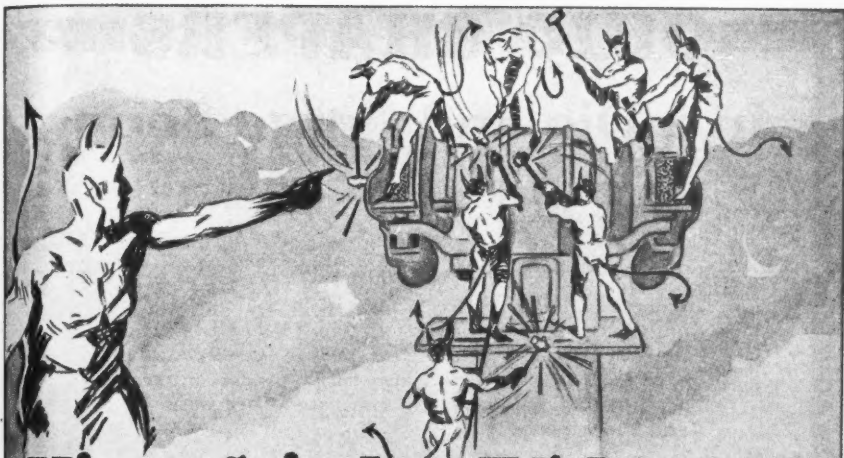
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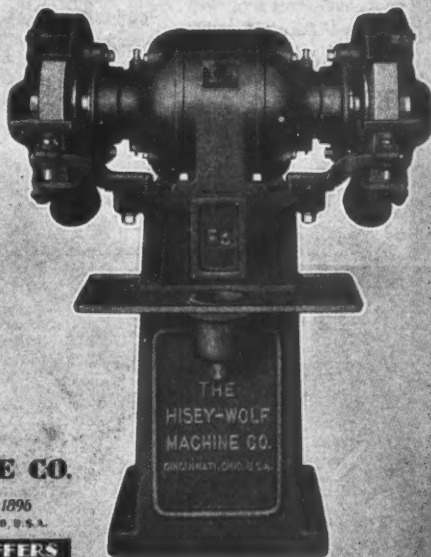
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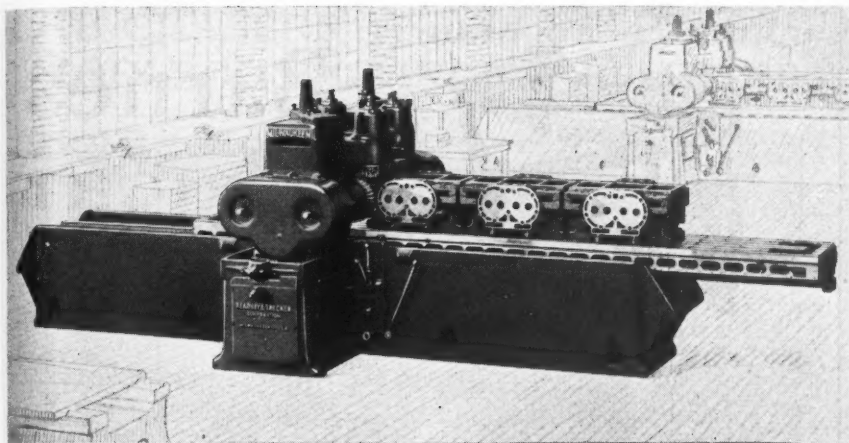
Note the table jack which equalizes the weight between the rail and table support and assures the operator of perfect alignment.

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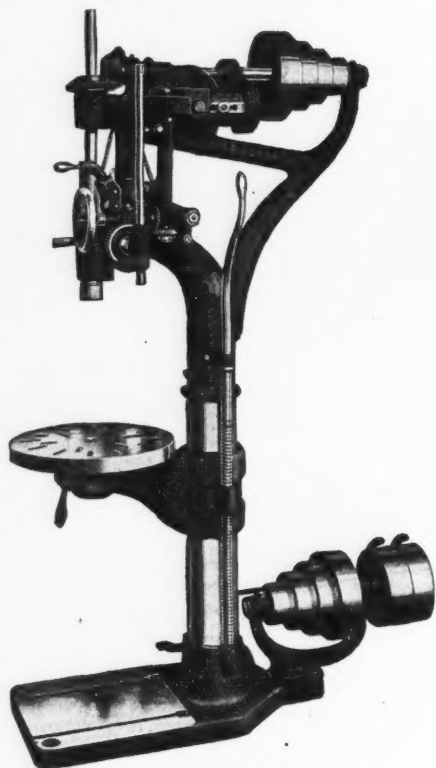
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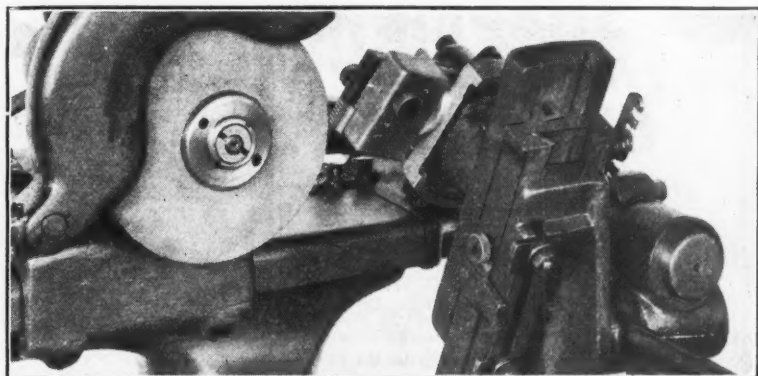
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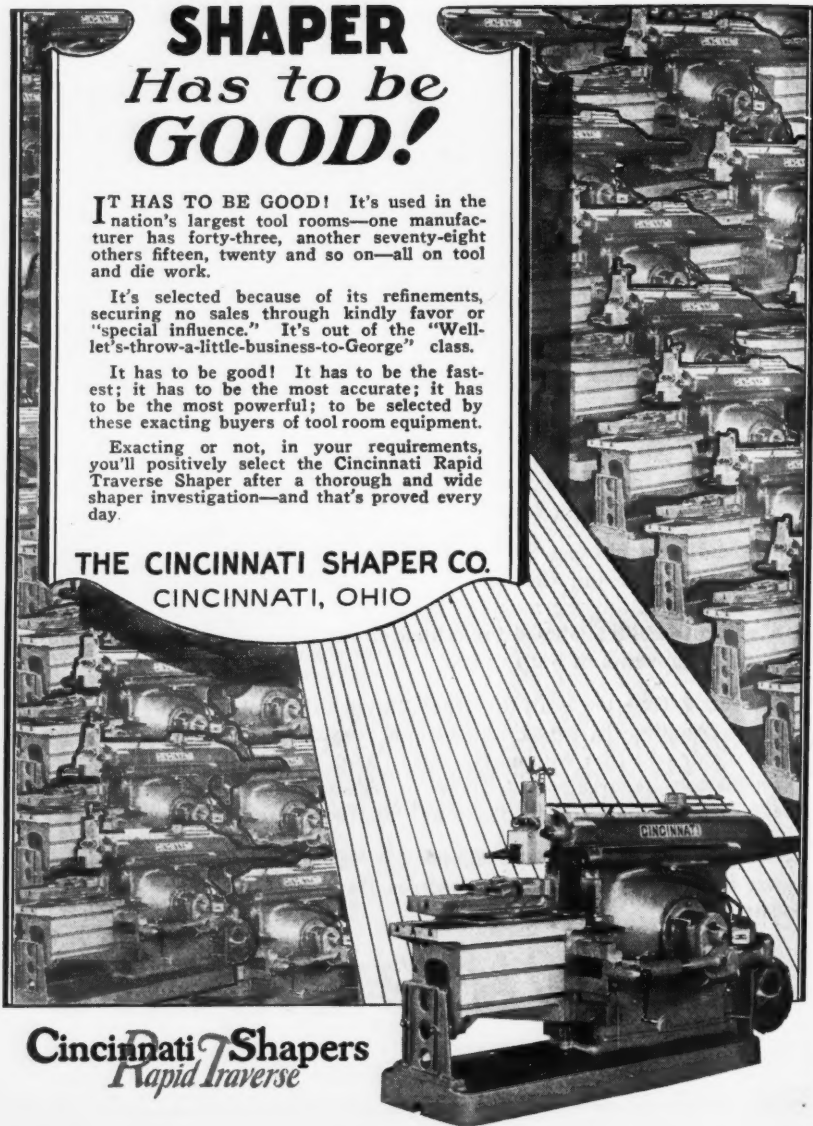
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CINCINNATI, OHIO



Cincinnati Shapers
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MODERN Machine Shop

A MAGAZINE FOR MACHINE SHOP EXECUTIVES

Published monthly at 128 Opera Place, Cincinnati, Ohio

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Vol. 1

MARCH, 1929

No. 10

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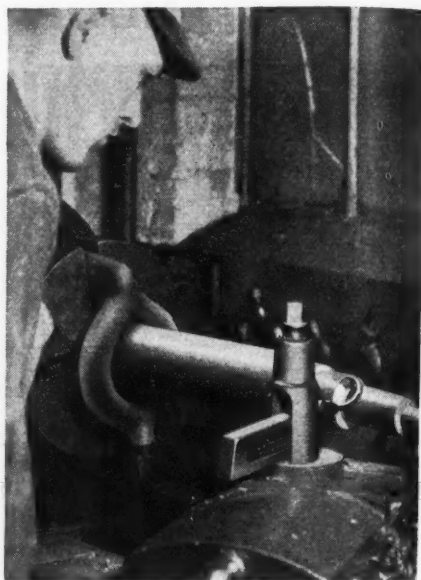
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MODERN Machine Shop

MARCH, 1929

CINCINNATI, OHIO

VOL. 1. No. 10

Operations in a Tennessee Railway Shop

By HOWARD CAMPBELL

THE machining of parts for locomotive repairs, as handled in the shop described in this article, involves a number of operations that are unusually interesting. It is apparent that each individual job has been studied with a view to reducing the time of operation or to increasing production, and special equipment has been applied wherever the use justifies the cost. Among the special tools in use is the double boring bar shown in operation in Fig. 1, where a Cisco lathe is shown in use for turning and

boring a valve packing ring casting. The piece is cast with two lugs at the bottom end so that it can be clamped to the faceplate, in addition to gripping it with the chuck-jaws.

The casting is bored and turned in one operation by the two bars which are clamped in a square iron block that is bolted to the compound rest. The square holes for the toolbits are cut through the bars at an angle so that the points of the tools extend slightly ahead of the ends of the bars, thus making it possible to machine

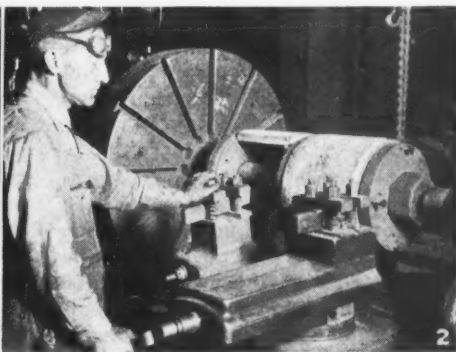
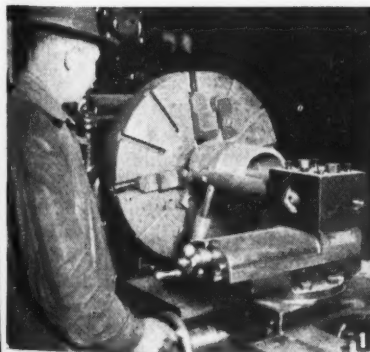


Fig. 1—Turning and boring packing ring castings in the Cisco lathe. Fig. 2—Turning two driving box brasses in one operation. The brasses counterbalance each other.

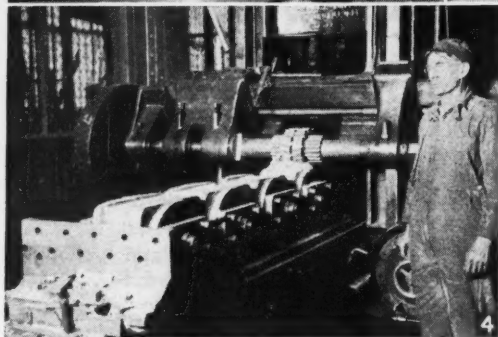
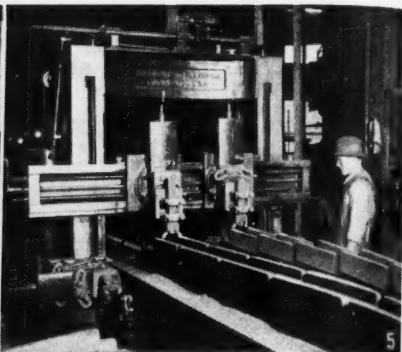
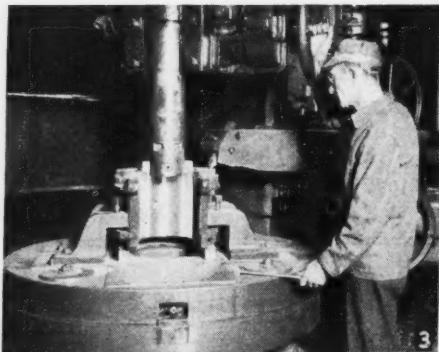


Fig. 3—A driving box is bored and faced complete in 30 minutes with this equipment. Fig. 4—Milling rear end main rod brasses. Fig. 5—Planing shoes and wedges on a Cincinnati planer. Note the double toolholders.

flanges at the ends and middle of the arbor, the flanges being keyed to the arbor to prevent them from turning. Two tools are used, one being held in an auxiliary toolholder attached

to the carriage as shown. The two pieces are turned simultaneously, although only one tool is in operation at a time. Only one cut is taken, and the two pieces are finished complete in approximately forty-five minutes.

Driving boxes are bored and faced in a special boring mill, shown in operation in Fig. 3. The boring is done with a Davis boring bar, which is equipped with two cutters that are controlled by a micrometer adjustment. As the journals vary in size, the tools require re-setting for each box in order that the box may be bored to size without "cutting and trying." While the boring cut is in process, a side head carrying a 1½-inch square tool is brought into play and the flange is faced and filleted.

the casting close to the chuck-jaws. A jack, placed between the carriage and the turning tool, offsets the tendency of the bars to spring downward under a heavy cut. After the piece has been bored and turned, a holder carrying a gang of six cutting-off tools is clamped to the compound rest and the rings are cut off. The operation of boring, turning, and cutting off twelve rings takes about three hours.

The old method of bolting a counterweight to the faceplate of the lathe to balance a driving box brass while it was being turned has been improved upon in this shop by the method shown in Fig. 2. Here an arbor is shown holding two brasses, arranged to counterbalance each other. The pieces are held by setscrews in the

Fig. slot
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A box is machined complete, floor to floor, in thirty minutes.

The operation of milling rear end main rod brasses, for which a planer-type milling machine is used, is illustrated in Fig. 4. The pieces are clamped to the vertical side of a long angle plate that is anchored to one side of the machine-table, a short

whole line of pieces in position. The feature of the job is the manner in which the tools are applied. Each line of pieces is machined with a double tool, the two toolbits being set to the required dimension. Such tools cut the actual cutting time practically in half, saving both the machining time and the time that would

otherwise be spent in obtaining the proper dimensions. Sixteen pieces of one kind and twenty of the other are machined in eight hours with this equipment. Guides are also planed on this machine.

One of the most interesting operations in

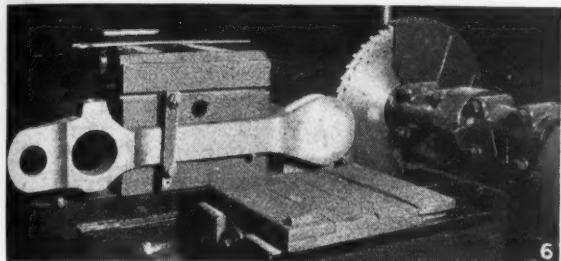
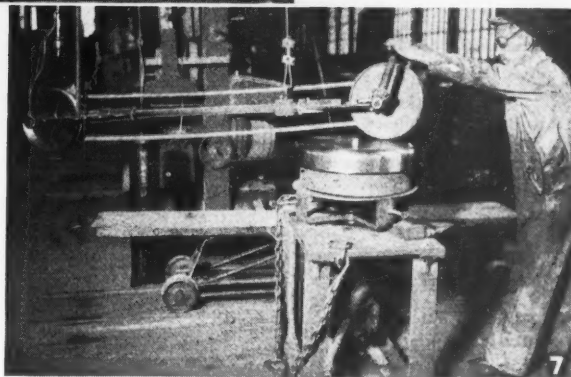


Fig. 6—Using a cold saw to slot the end of a side rod. The operation is completed in one hour. Fig. 7—Polishing a valve chamber head casing. The casing is revolved by an air motor while being polished.



angle plate, bolted to the end of the table, serving to prevent any "creeping" due to the thrust of the cut. The side of the piece is finished complete in one cut, a gang of four cutters of two different diameters being used, as shown. Five pieces can be machined complete in eight hours with this equipment.

Shoes and wedges are planed on the Cincinnati planer shown in Fig. 5. The pieces are clamped in a common type of fixture, with spacers between the pieces and a 1½-inch rod running through the whole length of the fixture, a nut on the end of the rod providing means for clamping the

the shop is that of sawing out the ends of the side rods, which is done in the cold saw shown in Fig. 6. The machine is shown in process of sawing out the end of a No. 4 Santa Fe rod, the slot being 2½ inches wide by 15 inches deep by 12½ inches across when finished. After the rod has been laid out, the inner end of the slot is drilled with a drill that is ⅛ inch larger in diameter than the width of the slot. The rod is then clamped in this machine, as shown,

and the block is sawed out to the layout lines. The two cuts are made in thirty minutes each, or an hour for the complete job. This time compares very favorably with the time required on other and more expensive machines, and this machine has the

Cylinder head casings are also polished with this outfit, the casing being held by set screws which are screwed out so that they press against the interior of the head. The set screws can be seen projecting from the fixture.

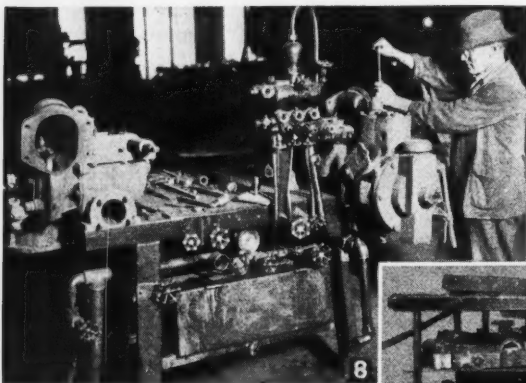
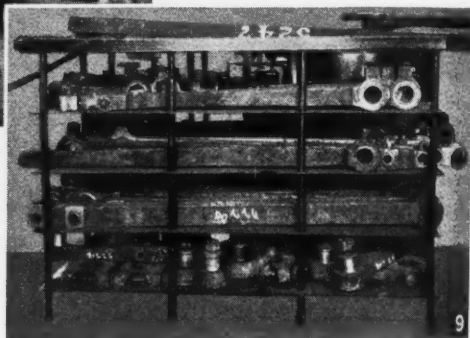


Fig. 8—Stoker engine work is handled on this especially-equipped table. Fig. 9—Racks like this are placed wherever needed and all tools and parts are kept off the floor.



added advantage that it does not require a highly-skilled mechanic to operate it. An automatic stop shuts the power off when the cut is completed, and in the meantime the mechanic can be attending to other work.

The mechanic shown in Fig. 7 is polishing a valve chamber head casing, using a swing grinder and polishing wheel. The casing is held in position by bolting it to a fixture which revolves so that every part of the head passes the polishing wheel. It is thus only necessary for the mechanic to move the machine from side to side to finish the complete head. Power to revolve the fixture is supplied by an air motor underneath the table upon which the fixture rests.

necessary steam connections that are required for testing the stoker engines after overhauling. Type "C" stokers are shown in position, the connections for the Type "B" stokers being located at the rear of the table. An overhead swing crane aids in handling the parts to and from the table.

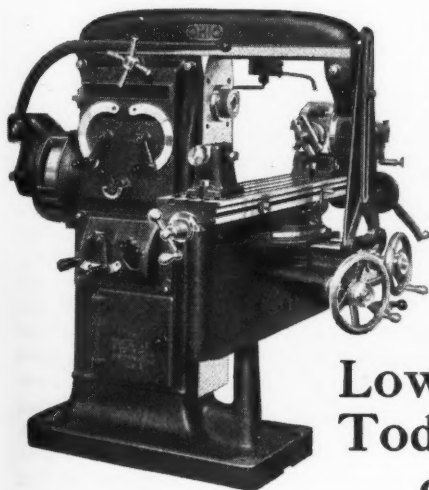
Cleanliness and safety are regarded as of first importance in this shop, as a result of which a rule has been made that all tools and materials must be kept off the floor. To this end a number of racks similar to the one illustrated in Fig. 9 have been made and placed wherever needed. The racks are made of old superheater pipe

(Continued on page 20)

NOW YOU CAN BUY A No. 2 Ohio Universal Constant SPEED MILLER FOR \$1775

(Equipped for motor, \$150 extra.)

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The Oesterlein Machine Company
Cincinnati, Ohio, U. S. A.

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MILLING
GRINDING DRILLING
EQUIPMENT

A Planning System for the Small Shop

By R. H. KASPER

ANYONE engaged in the building of machines or the assembling of machine units has had the experience of machining or assembling parts in what at first seemed to be the quickest way, only to find later that difficulties were encountered due to previous operations being performed at the wrong time. The foreman must be constantly on guard against such mistakes if he hopes to produce the work in the shortest possible time and at minimum expense. Mistakes occur in the best regulated families, but it is well to prevent, as far as possible, their recurrence. With this object in view, I had our draftsman make up a number of sheets upon which the various operations could be tabulated, giving special instructions where necessary. Two of these sheets are shown herewith; a brief discussion will serve to make their use clear.

The sheet Fig. 1 is a list of operations for assembling a wire machine. The material required is indicated in the upper left hand corner; although this information could be obtained from the blueprint, having it on the operation sheet tends to eliminate errors and save time in tabulating material. The upper right hand corner shows the sheet number, blueprint numbers and the date. The sheet is divided into six columns, giving the operation number, description of the operation, tools used, machines used, and specific instructions, which are listed in the column under "Remarks."

This sheet shows one point where a considerable amount of time is saved

by having the operations listed in the proper sequence. Operation No. 4 gives instructions "Locate temporarily," while under "Remarks" the instruction is given "Do not fasten shafts." In operation No. 6 these shafts are located permanently. Without a careful study of the blueprint, the workman would assume that operation No. 5—locate bearings and place shafts in position—should follow operation No. 3, but if this were done, it would be impossible to place the clutch shafts in position (operation No. 4) without again removing the shafts indicated in operation No. 5. Again, if the clutch shafts indicated in operation No. 4 are located permanently, they must be again removed to locate the bearings in operation No. 5. The saving in time is obvious.

In operation No. 7, under "Remarks," the instruction concerning the oil hole eliminates the possibility of the assembler overlooking the oil hole in pattern 246A.

The operation list Fig. 2 eliminates the possibility of error in several instances and outlines what has been found to be the quickest method of completing the work. The material list does not coincide, piece for piece, with the dimensions on the blueprint, as some of the parts can be more quickly machined when the material is cut to include two pieces. For instance, part A is of such shape that, singly, it would be difficult to hold for machining after a certain point is reached, whereas, by cutting the



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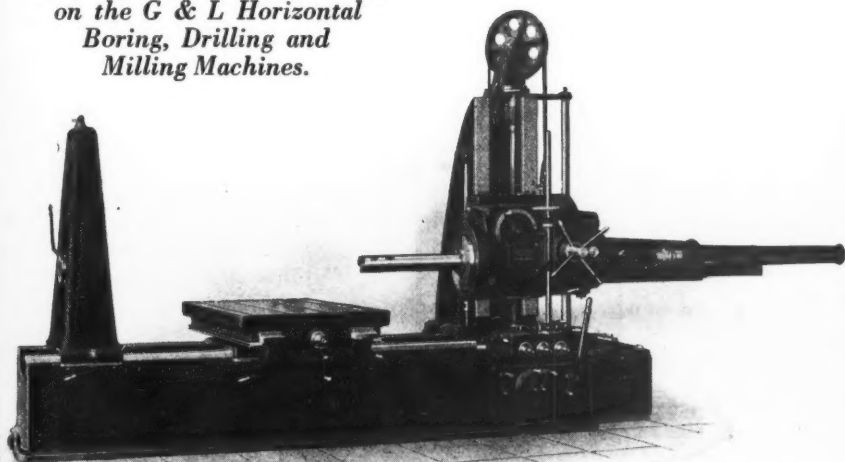
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MATERIAL		OPERATION LIST			LIST # 4
112 $\frac{1}{2}$ " CAPSCREWS		FOR _____			SKETCH # 687-704
96 #3 TAPER PINS		Assembling Wire Machine			DATE Nov 1, 1926
OR#	OPERATION	TOOL USED	TOOL#	MACHINE	REMARKS
1	Assemble frame.	Elec. drill $\frac{1}{4}$ " drill	146 R		Sketch #695. Clamp on surface plate. Spot through end brackets Two $\frac{1}{2}$ " screws Two pins - adjacent sides.
2	Attach pattern # 269 A Attach pattern # 271 A.	Drill press $\frac{1}{2}$ " drill $\frac{1}{32}$ " drill. $\frac{1}{2}$ " tap	362 B 293 B T 24	DRILL PRESS	Sketch #695. Measure from dividing line of bed Spot through.
3	Assemble and attach pattern #272-A - 273-A	Locating jig	1667	DRILL PRESS	Sketch #689. Locate pattern #272-A — 4.598" from top of bed. Check with inside micrometer.
4	Assemble clutch shafts and lower gear shafts Locate temporarily.				Sketch # 701 Do not fasten shafts
5	Locate all bearings on bed. Place shafts in position with gears.	Locating fixture. Elec. Drill.	1580		Sketch # 704 Pin bearings - #3 taper pins - One in each corner.
6	Locate clutch shafts and lower gear shafts.	Locating fixture	1576 A. 1576 B		With fixtures #1576 A-B in position on ends of shafts, bring clutch gears to mesh with driving gears. Pin in place.
7	Locate worm shaft bearings on Patt. # 246 A.	Locating fixture	1577		Drill oil-hole through Patt. # 246-A into bearing. Enlarge for oil-cups. Cut oil-grooves.
8	Locate Patt. # 246 A on Patt. #256 A.	Locating fixture.	1578		
9	Locate Patt. #249 A - 256 A - 252 A	Locating fixture	1575		
10	Attach motor.				Wires toward front. Switch between ends of frame.

Fig. 1—An operation list for a wire machine. By working to the instructions given opposite each operation number, the workmen can proceed with confidence that the work is being done correctly.

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These unique Screws are used by leading aircraft manufacturers to make strong fastenings—quickly and easily . . .



NO AIRCRAFT MANUFACTURER will sacrifice security to time and cost. But when security can be attained by a method which affords more economical production through speeding assemblies and cutting costs, the aircraft manufacturer quickly takes advantage of the opportunity.

Wright Aeronautical Corp.; Curtiss Aeroplane & Motor Co., Inc.; Ireland Aircraft, Inc.; Fokker Aircraft Corp.; Velie Motor Corp.; and Consolidated Aircraft Corp.; all use Parker-Kalon Self-tapping Sheet Metal Screws and Parker-Kalon Hardened Metallic Drive Screws to make secure fastenings quickly and easily.

Foremost manufacturers in every industry use these Screws to make assemblies without costly tapping, time-wasting riveting or bolts and nuts. Typical users are: Ford Motor Co., General Electric, New York Central Lines, Eastman Kodak Co., Victor Talking Machine Co., Frigidaire Corp.

Self-tapping Sheet Metal Screws

For joining sheet metal or making fastenings to sheet metal. First, punch or drill a hole. Then, turn in the Screw with a screwdriver as shown to the right. As the Screw is turned in it cuts its own thread like a tap.



Hardened Metallic Drive Screws

To make secure fastenings to iron, brass and aluminum castings, steel, Bakelite, etc.—just drill a hole and drive in the Screw with a hammer. The screw cuts its own thread as it is driven in.



Try these Screws. Tell us what you want to fasten—we will send samples.

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Parker-Kalon SELF-TAPPING SCREWS

PARKER-KALON CORPORATION, 192-196 Varick St., New York, N. Y.

Please send me a handful of Hardened Self-tapping Screws. (Sheet Metal Screws—Drive Screws)—check one or both. I want to try them out for

Name Address

MATERIAL				OPERATION LIST		LIST # 2
4-D.R.-0.182" x 1				FOR		SKETCH # 708
1-C.R.S.-1 1/4 x 1 x 2 1/2				Die Holder for		DATE
1-C.R.S. 3/4 x 3/4 x 2 1/2				Forming Press		March 22, 1926
4-C.R.S. 1 1/4 x 1/8 x 1/16						
16-D.R.-0.063 x 3/16						
2-C.R.S.-1/4 x 1/8 x 1/2						
10-5-40 x 3/8 R.H. SCREWS						
OP#	OPERATION	TOOL USED	TOOL#	MACHINE	REMARKS	
1	Part A-Reduce to 1 3/16" Machine Shank	6" side milling cutters Limit gauge	1430A 1130	SHAPER MILLING	Top & bottom in one piece Shanks on ends. Straddle mill	
2	Part A. Cut 5/8" groove. Cut inside grooves.	5/8" milling cutter. Master Tool.	343 663	MILLING SHAPER	Cut 0.050 deep.	
3	Part A- Cut 1/32" slots Cut off Reduce to 1 1/16"	1/32" drill 5/8" end mill Milling fixture	261 943 1083	DRILL PRESS MILLING MILLING	Mark top and bottom	
4	Part B- Reduce to 5/8" Cut 5/8" groove Cut inside grooves	3/8" cutter Special cutter	462 251	SHAPER MILLING MILLING	Allow 0.003 for grinding Cut 0.050 deep	
5	Part B- Cut off Grind. Clamp in Part A	Saw	918	MILLING GRINDING	1" long Fit into Part A.	
6	Parts A and B Drill 0.182 Ream	#29 drill #16 drill Rose reamer	1000	SPEED LATHE SPEED LATHE DRILL PRESS	Drill on center. Halfway from each side Small drill first. Ream through.	
7	Part B Reduce to 3/8" Fit 0.182 D.R into groove			SHAPER BENCH	Sliding fit	
8	Parts A, B & C Drill and Tap holes	Drills # 51-53-37-29-8-5-40 Tap 1/4-20 Tap	T 16 T 18	DRILL PRESS Bench.	Part C- trim off excess after drilling	
9	Make springs and clamps	Forming jig	1643	BENCH	Use unhardened Steel wire	
10	Assemble and lubricate			BENCH		

Fig. 2—Without this list of operations, finish operations would be performed at the wrong time and work would be spoiled.

SPEED UP production with a *Thor* **ELECTRIC SCREW DRIVER**



Drive your screws by electricity - - and save assembling time! No tiresome turning the screw driver by hand - - no fumbling - - no cramped fingers - - just insert the tool in the slot and press the button. Zip - - it's in.

No matter what the design or construction of your product, it can be assembled by power. Our engineers have made a study of assembling problems, and as a result have designed over thirty-five different types of attachments for use in driving screws in difficult and unusual places, on all kinds of assembly work.

If your screw-driving operation is simple, a *THOR Electric Screw Driver* will double your output. If it is difficult, we will more than double your output, in addition to making an easy job out of a hard one. A *THOR Electric Screw Driver* will pay for itself in a short time.

Submit your assembling problem to us; consultation is free. If possible, send sample of your product. If not, send sample of screw used, size of lead hole, kind of material, location, and space surrounding operation. Our engineers will be glad to study your problem and submit suggestions to increase your production. The benefit of their experience is yours for the asking. *Write today!*

TOOLMAKERS SINCE 1893

INDEPENDENT PNEUMATIC TOOL CO.
PNEUMATIC TOOLS 236 South Jefferson St. ELECTRIC TOOLS
CHICAGO, ILL.

stock of double length, this difficulty is not encountered.

In operation No. 5, part **B** is cut off 1 inch long, but in operation No. 7 it is further reduced to $\frac{3}{8}$ inch. This is a point, which, if overlooked, would result in defective work. By cutting part **B** 1 inch long, it exactly fits into part **A**, which is also 1 inch long. Part **B** carries two half-round grooves on the outer surfaces while part **A** has two half-round grooves in its inner surfaces. When these two parts are placed together, the two sets of grooves must exactly coincide. This is accomplished by first grooving the part (operations 2 and 4), inserting part **B** into part **A**, clamping them

together (operation No. 5) and drilling and reaming between the two (operation No. 6). If part **B** were cut off $\frac{7}{8}$ inch long, which is the finish size, it would be $\frac{1}{8}$ inch shorter than part **A**. Then if the parts were drilled in this condition, a distinct offset would be formed in the half-round groove in part **A**, caused by the drill completing its cut in part **B**.

The use of these sheets has saved many hours of time, as the workmen can proceed with the work with full confidence that they are working according to a plan that has been worked out and proven correct by experience.

Operations in Railway Shop

(Continued from page 12)

and $\frac{1}{8}$ -inch tank steel, with rods through the pipes to hold the rack together. The sheets are cut to 5 x 8 feet and $1\frac{1}{8}$ -inch holes are drilled at the corners and other places where the rods are to pass through. The pipe is cut to length according to the space required between shelves and, when the rack has been assembled, nuts are screwed onto the ends of the rods to hold the rack together. The bottom shelf is seven inches from the floor in all cases, thus making it possible for the sweeper to clean under the rack. Being made of discarded materials, the racks are inexpensive and have more than paid for themselves by increasing the general shop efficiency.

Learn To Make Time-Studies

While it may not be advisable to try to use piece-rates in a shop that is doing a general jobbing business that includes a variety of work, the small shop that is producing quantities of work of one kind can make use

of time-studies as well as the larger shops. It often pays to have a special time-study man for a shop employing twenty or thirty men, but in a shop as small as this the foreman can make the time-study work a part of his duties.

Time-studies not only show the exact length of time that is required to machine a piece, but it also shows up all the inefficiencies in the placing and handling of the work, selection and grinding of the tools, design of jigs or fixtures, and so on. A foreman who starts making time-studies of the various operations in his shop or department will be surprised at the amount of lost motion that will be shown up, due either to the inefficiency of the workman or the poor operation of the tools. The analysis of a job through the making of a time-study will often give a foreman an idea for the design of a better tool or fixture, or a better method handling the job, by which material savings can be effected and the production increased. Every foreman should have a stop-watch and know how to make time-studies.

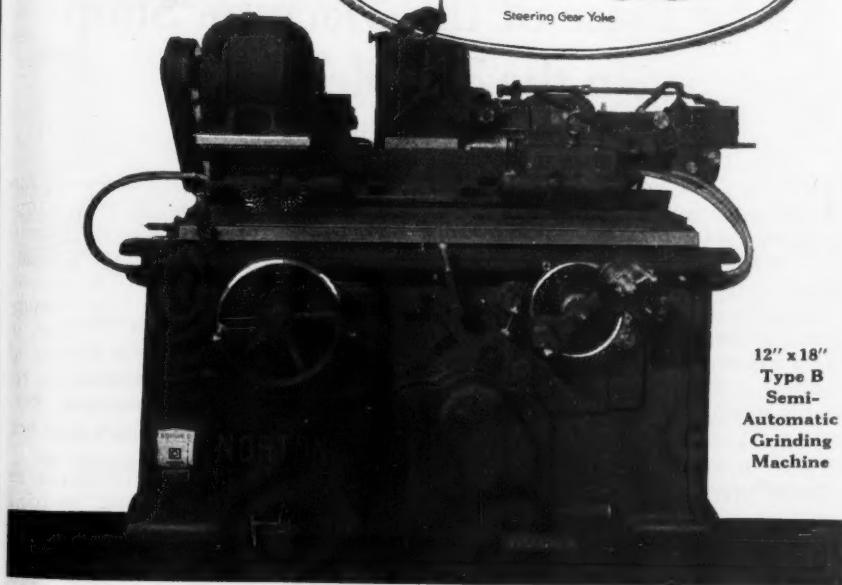
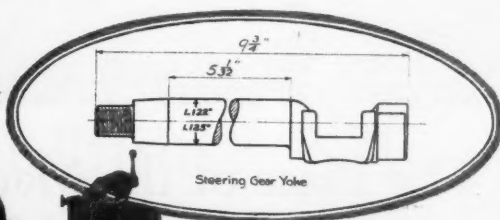
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Former Production—75 to 80 per hour. Semi-Automatic Production—160 to 180 per hour.

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Previous Operation	Turn
Stock Removal007" — .008"
Tolerance001"
Grinding Wheel—	
	Norton "Alundum"
	20" x 7" — 24 CL

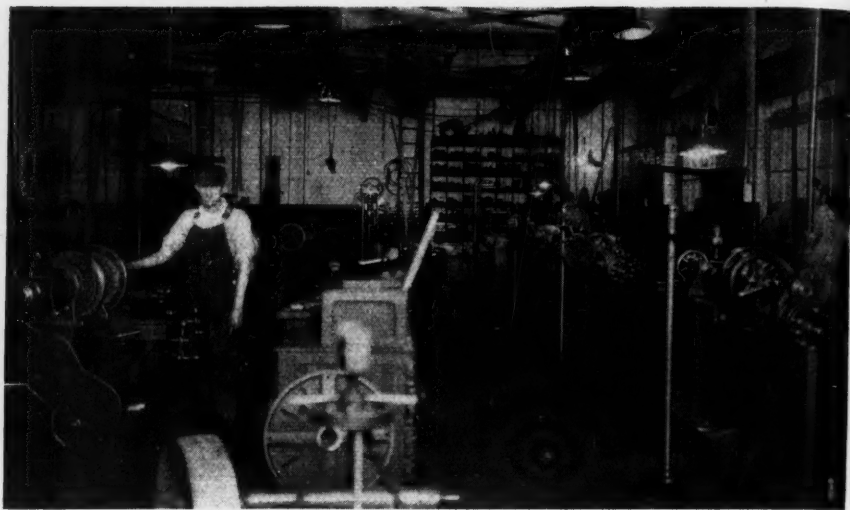
THE AUTOMATIC FEATURES of this Norton machine reduce manual operations and resulting fatigue to a minimum. The ruggedness of the design with powerful drive for wide wheels reduces the actual grinding time.

With this combination of features maximum day in and day out production is assured.



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Type B
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The Place of the Machine Shop in the Textile Mill

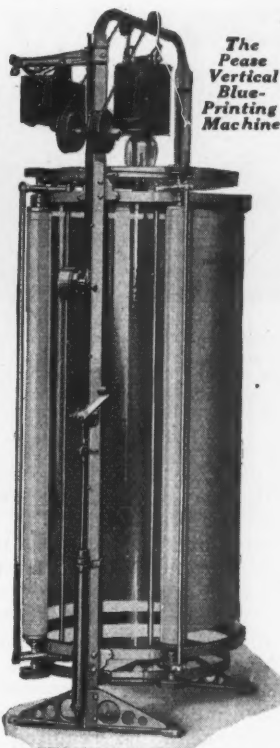
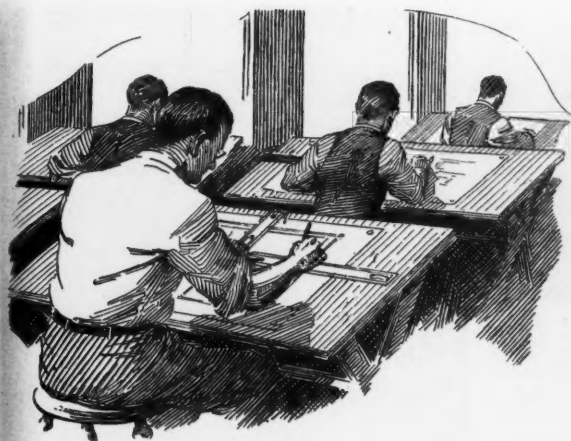
By H. E. WINTER

THE phrase "textile mill" usually brings to mind a vision of endless rows of spinning frames and looms into which huge quantities of clean, white cotton or wool are fed, to emerge in the form of cloth. There seems to be no room in this picture for a machine shop, yet the machine shop is a very important part of a textile mill.

The textile industry is one of the largest and most important in the United States, ranking first in the number of employees and second in the value of the materials produced. There are more than 10,000 textile mills in the country, of which approximately one-third employ upward of 100 people each. Of this 10,000, nearly 50 per cent are cotton mills.

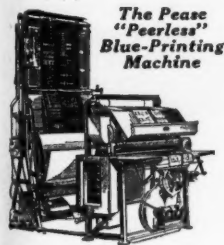
Each textile plant represents an enormous investment, not only in production machinery, but also in engines, boilers, pumps, electric motors, blower systems, elevators, air compressors, conveying systems, and other equipment, all of which must be kept in repair. More than 500,000 motors of all sizes are in use in textile mills, requiring the use of more than \$32,000,000 worth of rope, chain and belt drives.

The intricate tasks performed by some of the spinning and weaving machines involve the use of complicated mechanisms in which a great many shafts of all sizes are used, running in all kinds of bearings—ball, roller, and of the plain bronze type. Each machine is composed in part of driving pulleys, gears, rollers, and other parts



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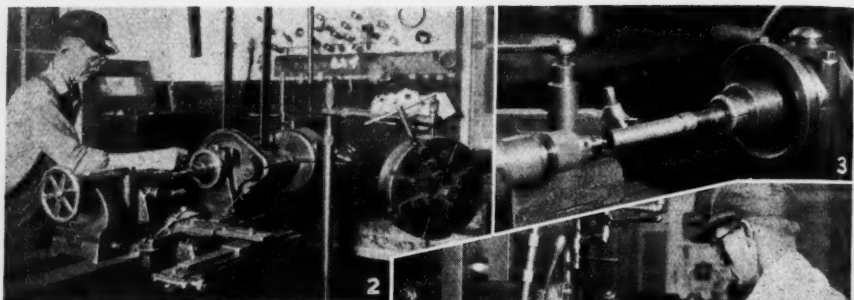


Fig. 2—Making a new part for a machine in a cotton mill. Fig. 3—Driving a shaft by means of an expansion bushing. Fig. 4—Splitting a cast iron bushing. The Brown & Sharpe miller is in constant use.

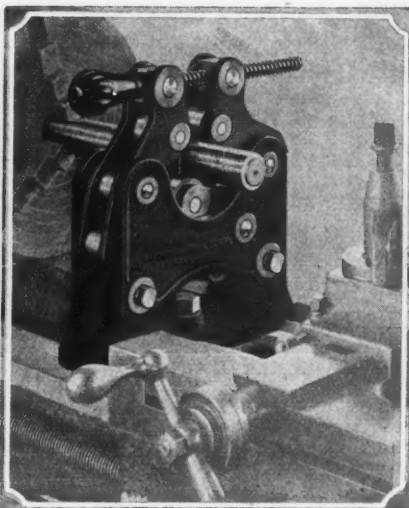
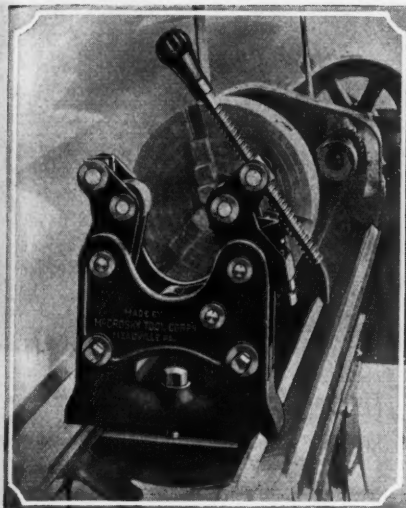
that break down or wear out sooner or later. Each item mentioned in the foregoing represents, potentially, at least, work for the machine shop.

One of the largest textile mills in the country is the cotton mill of the Pepperell Manufacturing Co. at Lindale, Georgia. When this plant is running at capacity, the amount of maintenance work required keeps practically every piece of equipment in the machine shop in operation. This equipment includes seven lathes, a gear cutter, a planer, a milling machine, a shaper, large and small drill presses, and a power press. A view of one side of the shop showing the double line of lathes is shown in Fig. 1. The efficiency of the department is indicated by the clean condition of the floor. Lathe chucks are kept off the floor by use of special cranes—one behind each lathe—which also simplify the task of handling the chucks to and from the spindles.

A closer view of one of the chuck-cranes is obtained in Fig. 2, from which it is possible to note the construction. The vertical column is a section of shafting that is threaded

and screwed into a flange which is bolted to the floor. At the upper end, the shaft is turned and threaded to take a cylindrical nut, which is knurled for ease in turning by hand. The arm is drilled to slip over the stud at the top of the vertical shaft, and the chuck is held by a stud, one end of which screws into a hole in the chuck while the other end is held by a knurled hand-nut. The chuck can be adjusted for height by turning the hand-nut. This crane keeps the chuck clean and out of the way, besides making it possible for one man to thread the chuck on the spindle without extra effort.

The mechanic shown in Fig. 2 is turning a bearing on one section of a draw frame roller, using an expanding mandrel to hold the piece at one end and with the tailstock center in the opposite end. The expansion bushing slips into the machine spindle and, besides centering the work perfectly, drives it without use of a dog. A closer view of the bushing, hold-



For turning, facing, boring, and performing similar operations on the ends of long parts only one type of steadyrest meets the modern demand for speed and accuracy—the McCrosky SELF-CENTERING Steadyrest. It cuts set-up time by 50 per cent and greatly reduces spoilage due to imperfect centering.

With the McCrosky Rest the operator has only to insert the work, close the jaws, turn the tightening screw, and he's ready to begin work. He can go from one diameter to another with no adjustment except a few turns of the tightening screw. The McCrosky Rest takes a range of $\frac{3}{8}$ " to $3\frac{3}{4}$ ".

The work is gripped by three hardened rollers mounted on self-lubricating bearings. The rollers come instantly and simultaneously together when the jaws are closed. A McCrosky Rest on one of your surplus lathes makes an ideal centering machine.



Self-Centering Steadyrest

McCrosky Bulletin No. 11-C will help you determine the advantages of a Self-Centering Steadyrest on your work. Send for a copy.

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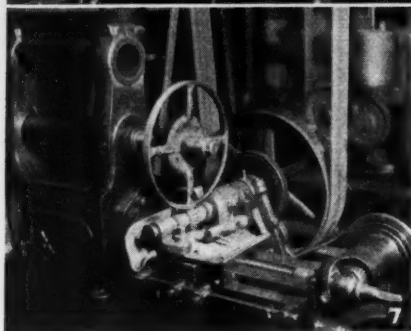
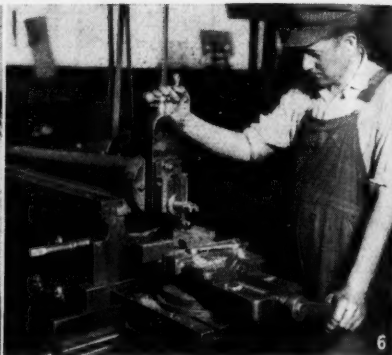
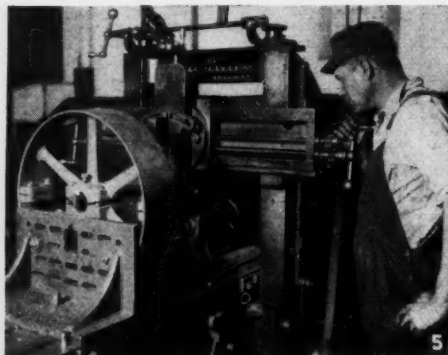


Fig. 5—Cutting a keyway in a pulley for a fly frame. Fig. 6—Machining the back for a replacement bearing. Fig. 7—Cutting teeth on a ratchet for a loom.

ing the work, is illustrated in Fig. 3.

One of the busiest machines in the shop is the Brown & Sharpe No. 2 milling machine, shown in Fig. 4. This illustration shows the machine in process of cutting a cast iron bushing in half.

The illustration Fig 5 shows the operation of cutting a keyway in a driving pulley for a fly frame, for which a planer is used. The pulley is clamped to an angle plate and a special horizontal cutter-bar is used. Smaller jobs of this type are machined on the shaper, Fig. 6. This illustration shows the shaper in use for machining a seat on the back of a removable bearing.

Gear and ratchets are constantly in demand in a textile mill, due to the fact that a certain percentage of the

many thousands of gears in use are sure to be broken each day. An automatic gear-cutting machine is shown in Fig. 7, cutting teeth on a ratchet for a loom. One of the drill presses is shown in Fig. 8, in use for drilling holes in a flange.

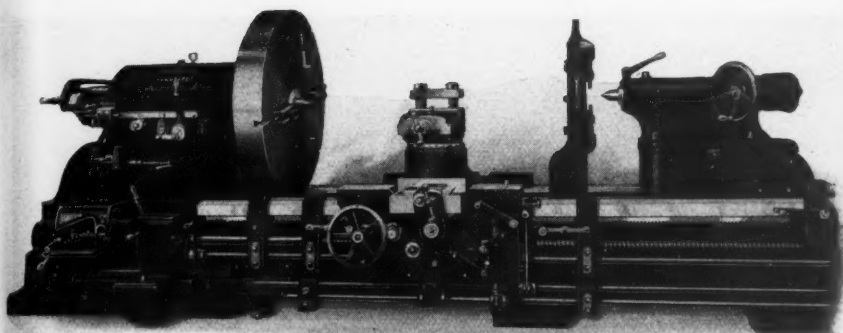
The development of gas and electric welding has enabled the textile mills to save many thousands of dollars per year through the reclamation of parts that would otherwise have to be thrown away. And this is not taking into account the value of the productive time that is saved by being able to put the machine into production within an hour or so instead of having to wait—as might easily happen—for parts to be shipped in.

The mechanic shown in Fig. 9 is using an acetylene torch to weld a broken crankshaft, which is part of the mechanism of a loom. At either side of the "throw" is a bearing which wears out in the course of time. The shaft is cut off next to the throw and a new section is welded on. A new bearing is then turned on the

4

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Send for complete description of our line of Lo-Drive Lathes, which, on account of patent, cannot be supplied by any other lathe builder.

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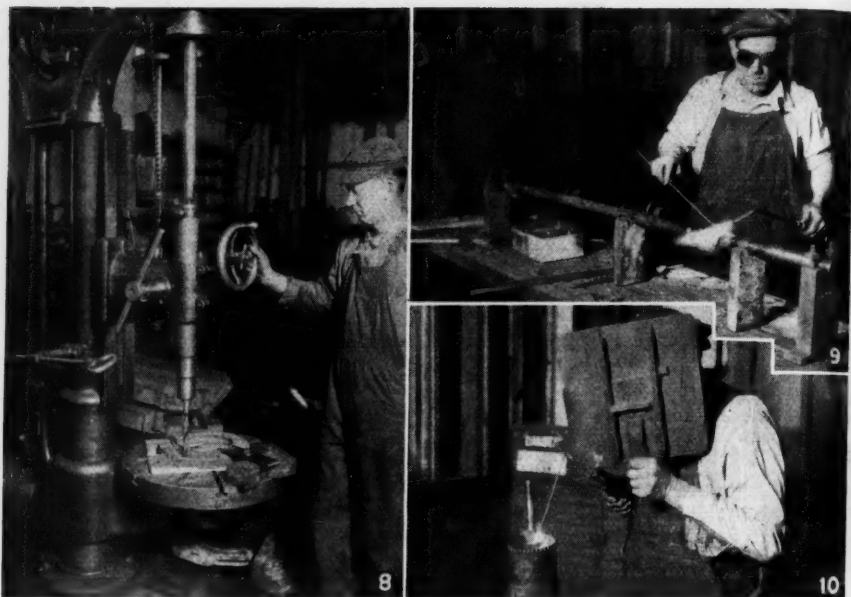


Fig. 8—All the heavier drilling is done on this machine. Fig. 9—Welding a new section onto a broken crankshaft. Fig. 10—Using the arc welder to anchor a loose journal in place.

shaft and it is ready for duty again. There is enough of this kind of work to keep two welders busy most of the time.

Some of the jobs, such as the piece shown in Fig. 10, are handled easier with the arc welder. This piece is a roller for a loom, in which the journal at one end has become loosened. The hole is chamfered around the shaft, then the trough thus formed

is filled with metal, anchoring the journal in place. Shafts that formerly were discarded when the journals became worn are now reclaimed by building the worn parts up with metal. After the shafts have been turned to size, they are as good as new. It can readily be seen, from the information presented here, that the machine shop plays an important part in the production of textile materials.

Micro Internal Grinder Catalog

The Micro Machine Company, Bettendorf, Iowa, has issued a catalog composed of a series of folders describing the construction and uses of the various types of Micro grinding machines for various kinds of work. Illustrations are included showing the

Micro Internal Grinder in use in railway shops, Diesel engine plants, and in various other kinds of shops where parts are used that have to be ground internally. Instructions are given for mounting the work on the machine, for aligning the work properly, and for caring for the machine. Detailed specifications are given for the different sizes of the machine.



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Hundreds of flat surface jobs -- from small bearing caps to huge axle housings -- are being GARDNER-GROUND daily with extreme economy.

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Fig. 1—Battery of Open Hearth Furnaces at plant of American Rolling Mills Company.

The Nature and Properties of Iron and Steel. III.

By GEORGE M. ENOS

Assistant Professor of Metallurgy, University of Cincinnati

THE invention of the Bessemer process for making steel stimulated research and invention in the steel industry. Among the men prominent in the field was William Siemens, who invented the regenerative type of furnace. By 1868, he was successfully making steel from pig iron in an open hearth furnace, using iron ore as the oxidizing agent.

The Open Hearth Furnace is a furnace of the reverberatory type, and its capacity may range from one ton to two hundred tons. An ordinary-sized furnace holds about 100 tons. The gases from the furnace proper are very hot as they leave the furnace, and are passed through chambers (regenerators) containing checkered brick work where they give up much of their heat before escaping to the air. There are two sets of regenerative chambers located beneath the charging floor, one set being heated while the other is preheating the in-

coming gas and air. This arrangement permits reversal of flame direction as the gas and air burn in the furnace, and a temperature is thus attained which will keep the steel molten as it is refined. Figures 1 and 2 are views of this type of furnace. Some furnaces are mounted so that they can be tilted, while others are stationary.

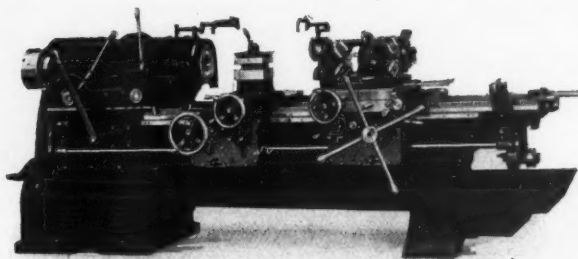
The charge to an "acid" open-hearth furnace is made up of steel scrap, with or without pig iron, and iron ore and a flux.

In the basic open-hearth process, the charge may consist of pig iron, iron ore and limestone, or of pig iron, iron ore, steel scrap, and limestone. The limestone contributes lime for the formation of a basic slag, which facilitates the removal of phosphorus and sulphur. In the open hearth process the solid materials is introduced into the furnace by a charging machine, similar to the one



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The ACME MACHINE TOOL Co.
CINCINNATI, OHIO

shown charging the furnaces in Fig. 1.

Steel can be produced in electric furnaces, using either an acid or basic process, but the electric furnace is more commonly used to super-refine the molten product of the Bessemer or open-hearth. This super-refining process produces a superior grade of steel, since the high temperature attainable permits the use of special slags for removal of small amounts of phosphorus and sulphur which are ordinarily left in the usual processes. Electric furnaces of the type illustrated in Fig. 4 are often used for melting steel scrap for making steel castings in foundries.

CHEMISTRY OF THE PURIFICATION PROCESSES

The processes for the manufacture of wrought iron and steel from pig iron are essentially processes of purification of the pig iron. The impuri-

ties contained in pig iron, viz.: silicon, manganese, phosphorus, sulphur and carbon, all have a high affinity for oxygen. Phosphorus can only be removed by oxidation, when the oxide formed can be combined with a basic slag. When a high percentage of lime is present, sulphur forms a compound, which dissolves in the basic slag. Silicon, manganese, and carbon are oxidized by iron in the order given. In any of the processes, iron oxide is the direct source of oxygen for the oxidation of the impurities. In the Bessemer process the iron oxide is formed by blowing air through the molten iron. In the basic open-hearth the iron oxides form a part of the charge. Where a large amount of scrap is used, as in the acid open-hearth process, rust may be an important source of the iron oxide needed.

At the conclusion of any steel mak-

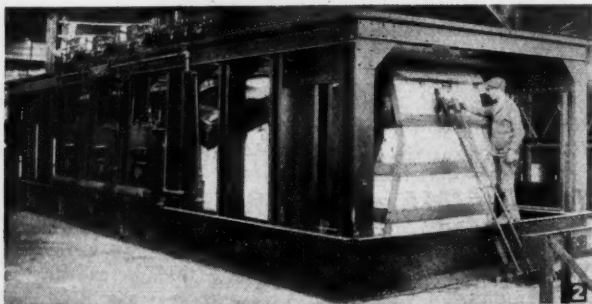
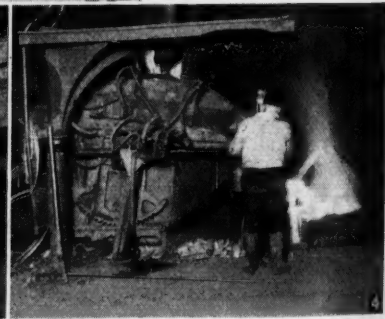


Fig. 2—A 15-ton Oil-Burning Open Hearth Tilting Furnace at Atlas Crucible Steel Co. Fig. 3—Tapping Side of Stationary Type Open Hearth Furnace, with steel ladle in foreground. (Taken at American Rolling Mills Co.). Fig. 4—Using an Electric Furnace to melt steel at plant of Dayton Steel Foundry Co.



ANDERSON TIME-SAVING TOOLS

ANDERSON TIME-SAVING TOOLS

ANDERSON TIME-SAVING TOOLS

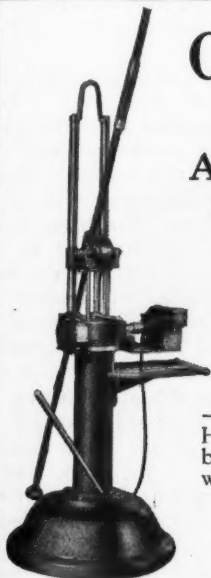
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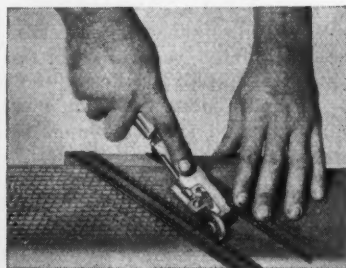
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ANDERSON TIME-SAVING TOOLS

ing process some iron oxide will remain dissolved, or mechanically entrapped in the molten steel. This may produce an inferior grade of steel if it is not removed.

It is logical to employ small amounts of silicon, manganese and carbon to rob the iron oxide of its oxygen, since each has a higher affinity for oxygen than does iron. Any slight excess of silicon used will alloy with the iron, with no injurious effects. An excess of manganese and carbon are always added, since it is desired to regulate the percentage of these elements in the steel. These elements are usually added to the molten steel as ferro-alloys such as spiegeleisen, ferro-manganese, and ferro-silicon. While it is possible to stop the refining process when the carbon percentage is at the desired value, the elimination of the other impurities may not be complete, hence it is customary to reduce the carbon to a low value, say 0.10 per cent and then "recarburize" as well as "deoxidize" by adding the ferro-alloys, which usually supply enough carbon. If they do not, then coke or anthracite coal are added.

The common deoxidizers, recarburizers, and degasifiers used as described above include the following: spiegeleisen, containing 15-30 per cent manganese and 4.5 to 5 per cent carbon and the balance iron and silicon, used as a molten addition principally in the manufacture of Bessemer steel; Ferro manganese 78-82 per cent manganese, 6-8 per cent carbon, balance iron, used principal in producing low carbon open-hearth steels; pig iron, coal or coke, and aluminum. Aluminum is not a recarburizer.

COMPARISON OF PROCESSES

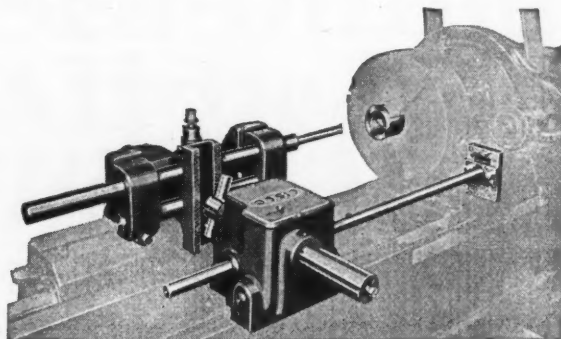
Comparing the various processes, it is found that the basic open-hearth produces by far the largest tonnage

of steel in the United States. Capacities, time of operation, and other features of interest are listed in Table 1.

It may be pointed out that acid processes produce steel that is freer from slag inclusions than the steels produced by the corresponding basic processes, but acid steels usually contain higher percentages of phosphorus and sulphur than basic steels. Good steel can be produced by any of the processes mentioned; the mention of the "quality of product" in Table 1 simply indicates the usual results obtained in commercial practice. The basic Bessemer process is not used in the United States because the kind of ores which are available for the production of pig iron make it more desirable in the long run to use the basic open-hearth for refining pig irons which must be handled in a basic furnace. Electric steel and duplex steel are produced by super-refining the products of other steel making processes.

THE INGOT STAGE OF STEEL MANUFACTURE

When the furnace processes have been completed, regardless of the type of furnace employed, the molten metal and slag are poured (from a converter) or tapped (from an open-hearth) into a ladle as shown in Fig. 3. Recarburizing and deoxidizing materials may be added at this time. The ladle, handled by an overhead crane, is placed above the ingot molds, and the metal is allowed to flow from the bottom of the ladle into each mold in turn, care being taken to prevent splashing against the sides of the mold. The metal may be introduced at the bottom of the mold if desired. The flow of the metal from the ladle may be checked by means of a refractory covered stopper within the ladle, operated from the side, as shown in



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Fig. 5. The operation of filling the molds is known as "teeming." A few ounces of aluminum are usually added to each mold as the metal is teemed—as a final step in deoxidation.

The ingot molds vary in size and design. They are generally made of cast iron and are open at both ends, and stand six or seven feet high. The section may be square with an edge

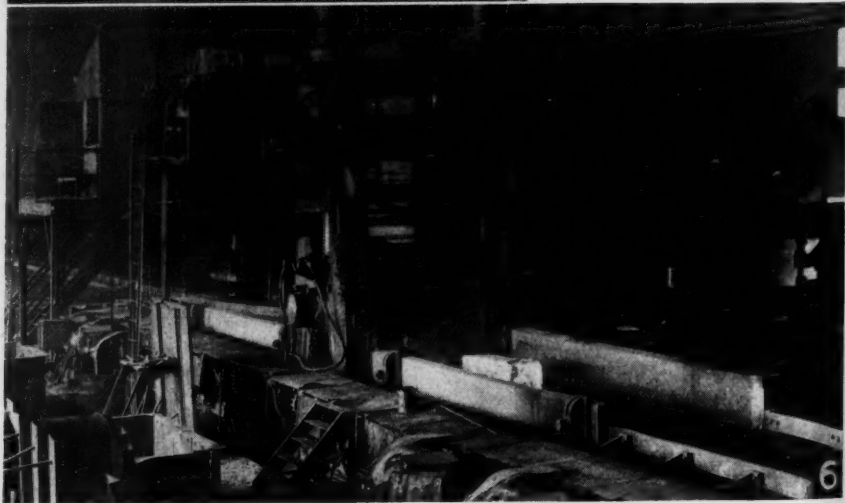
of 25 inches at the bottom and with a taper from the bottom to the top to allow the mold to be stripped from the ingot after the outside of the ingot has solidified. The ingot molds rest on cards, and after being filled and the metal frozen on the outside, are hauled to the stripper, a device for pulling off the ingot molds, thus leaving the hot ingots on the cars.

The ingot may be allowed to cool completely, and then stored for future use, or they may be taken while still very hot to the "soaking pits," which are suitable furnaces, located near the rolling mills. There the ingots are heated to about two thousand degrees F.



Fig. 5—Teeming a heat of open-hearth steel. (Carnegie Steel Co.).

Fig. 6—Here you see the white-hot ingot hurrying on its way to be squeezed between the rolls of the blooming mill.



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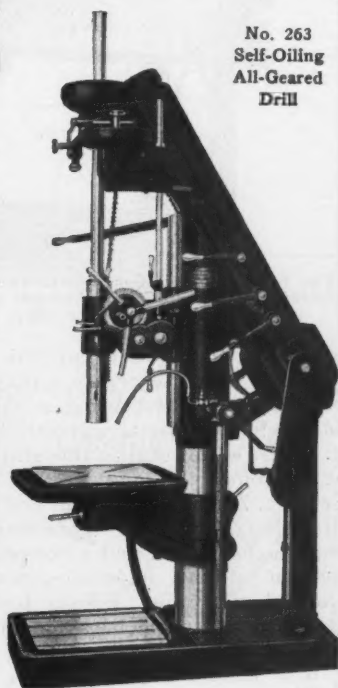
THE sliding head on the No. 263 Self-Oiling All-Geared Drill illustrated facilitates handling long work and piloted boring bars. The table swings so that work can be mounted on the accurately finished base of the machine if desired. Speeds and feeds—eight of each—are All-Geared and clearly indicated. The 263 is abundantly powerful and accurate to the fourth decimal. No. 266 is the same size machine with square column and sliding table.



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The hot ingots are lifted from the pit in turn and started through rolling mill operations. (See Fig. 6). It is obvious that ingots charged cold will require a longer time for "soaking" in the furnace.

The solidification of the molten metal starts from the outside, next to the walls of the ingot mold, and proceeds inward. Due to difference of

such work in order to form parts for structural use.

THE HOT WORKING OF STEEL

There are three methods of producing steel shapes, viz., rolling, forging and pressing, of which the first is the most widely employed. When an ingot at the proper temperature is brought up to a rolling mill and inserted between the two revolving rolls, it is drawn through them in the direction of rotation. It is squeezed and flattened and elongated by the pressure. A single pass through a pair of smooth rolls would reduce a square bar to a rectangular one of a thickness equal to the distance between roll edges. (See Fig. 8a.) The edges, however, would be irregular and bulging. The pass would of course increase the length of the bar. Turning the bar edge on, and again passing through the same pair of rolls should produce a square bar greatly increased in length over the original

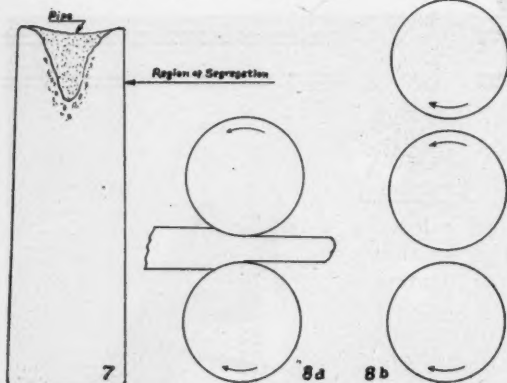


Fig. 7—Sketch of section through an ingot. Fig. 8a—Showing how rolls reduce thickness of bar. Fig. 8b—Illustrating principle of "three high" mill.

melting point between impurities and the steel itself, segregation may take place, most of it occurring at the top. In cooling the metal will shrink, and it is desired to localize this shrinkage at the top of the ingot as the "pipe." See Fig. 7. Thus, after the first stage of rolling, the end containing the shrinkage cavities, and a considerable portion of the impurities, may be sheared off. Many defects found in steel can be traced back to defective ingots. The subject of defects in ingots is summarized in Table 2.

From a consideration of Table 2, it will be concluded that the mechanical hot-working (rolling, forging, pressing) is desirable in correcting certain defects, aside from the necessity of

length, and reduced in cross-section. Now by decreasing the distance between the edges of the rolls, and proceeding as before, a square bar of uniform cross-section may be produced. By having suitable grooves cut in the rolls the same result may be obtained without changing the distance between edges of the rolls. Grooves of various design may be cut in the rolls so that shapes such as I-beams, channels, rails and the like, may be produced by a series of passes through one or more sets of rolls.

Rolling mills have been developed from a pair of rolls, which necessitates sending the piece back idle over the roll stand, to reversing mills and to "three high" mills which are used

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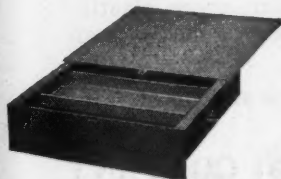
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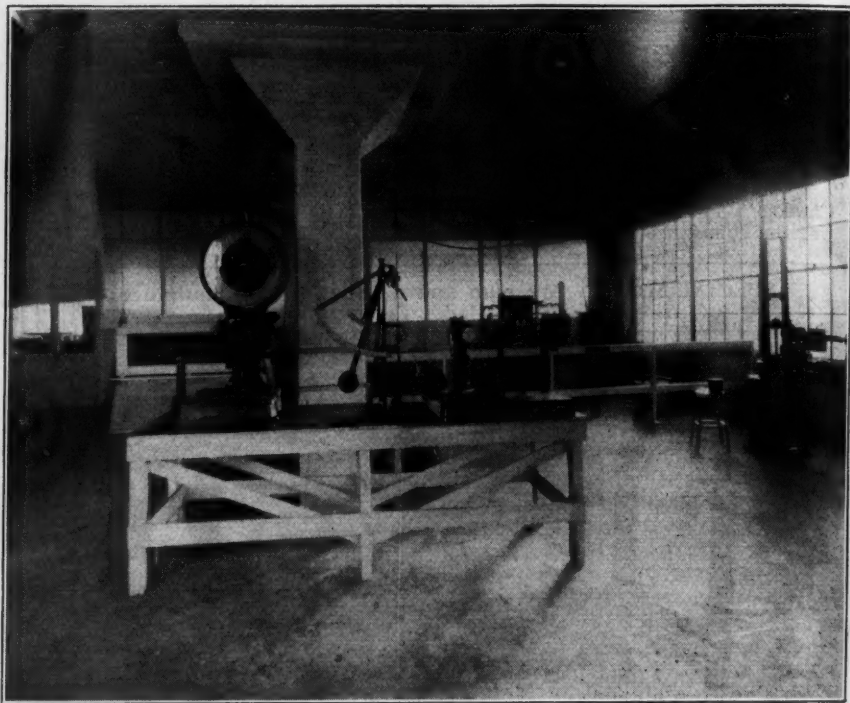
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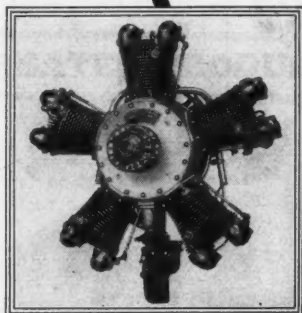
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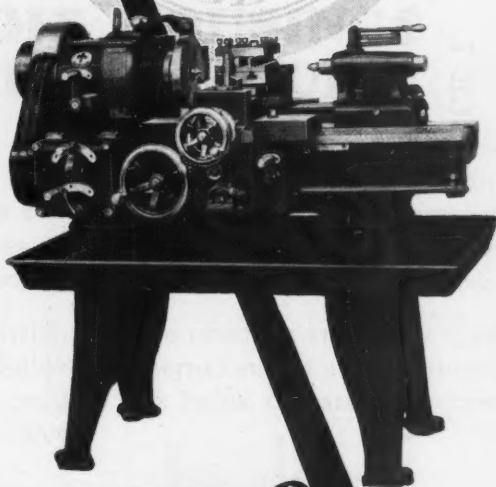


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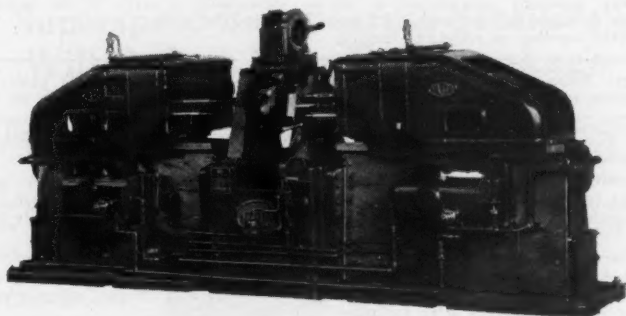
speed

TABLE I.
Comparison of the Bessemer and Open Hearth Processes for Making Steel

Process	Time of Operation	Fuel	Type of Lining	Capacity	Materials charged to furnace	Impurities removed from pig iron	Quality of product	Approx. percentage of annual production of steel in U. S.
Acid Bessemer	9-10 min.	none added	acid (gannister)	5-25 tons	molten pig-iron and air	silicon, manganese, carbon	fair	13.8
Basic Bessemer	15-20 min.	none added	basic (dolomite)	5-25 tons	molten pig-iron, air and limestone	silicon, manganese phosphorus, sulphur, carbon	good	none
Acid Open Hearth	6-10 hrs.	gas such as producer gas	acid (sand)	5-200 tons	steel scrap, pig-iron and iron ore	silicon, manganese, carbon, silicon,	good	2.1
Basic Open Hearth	10-14 hrs.	gas such as producer gas	basic dolomite or magnesite	5-200 tons	steel scrap, pig-iron, iron ore, limestone	manganese, phosphorus, sulphur, carbon	excellent	82.4
Crucible	2-3 hrs.	producer gas or other gas	graphite	100 lbs.	wrought iron, carbon, ferromanganese	slag	excellent	1.5



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THE above machine is a two way horizontal Hydraulic Multi-driller built up of two Standard Natco Type C 4" Hydraulic Units. It is equipped with the Natco Hydro Uni-power system of Hydraulic feed, which is semi-automatic in operation, the operator completely controlling the machine by one air valve.

The machine is equipped with a three position trunnion type fixture and performs the following operations on a well-known Bendix Housing. Drills a total of five holes, countersinks two holes and taper reams one hole.

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TABLE II.
Some Defects In Ingots and Their Correction

DEFECT	METHOD OF CORRECTION
Pipe: Cavity, generally cone-shaped, at top of ingot. The surfaces are generally oxidized and will not weld together on rolling or forging.	Shear off as early in the rolling operation as possible.
Blow Holes: Bubbles of gas entrapped in the metal during solidification.	If the surfaces have not been oxidized the blow holes will weld together on rolling.
Ingotism: Formation of excessively large crystals on solidification of metal.	Rolling, hammering, or forging breaks up the large crystals.
Segregation: Impurities which have collected and frozen together.	If near the pipe, the defective material is sheared off, otherwise no remedy except better practice in earlier stages.
Checking and Scabs: Rough surface of mold or improper pouring may produce cracks, or scabs, causing seams or slivers after rolling.	Bottom pouring of ingot, or greater care in top pouring. Proper preparation of ingot mold.
Non-metallic inclusions: Particles of slag or dirt may be entrapped. A source of blisters in finished product.	Proper finishing of heat in furnace, or better practice in deoxidation.

for many standard shapes. The three high mill has three rolls, with their axes in the same plane, arranged so that in operation, the bar passing through the lower pair of rolls in one direction, and through the upper pair in the opposite direction, is reduced in section in both directions. The grooves on the rolls are not shown in Figs. 8a and 8b. In 8b the diameters of the rolls are usually different.

Forging is best adapted for sections of less than three inches in thickness. Forgings may be made from small ingots or bars by hammering the steel which has been preheated to the proper temperature. Small forgings may be made by hand with hammer or sledge, and anvil. More intricate shapes are made with a series of dies, attached to the anvil and head of a steam hammer. These are known as "drop-forgings" and are widely used

in the automotive industries. Since the mechanical work is beneficial, they are often preferred to steel castings. Large forgings are made with steam hammers, which may handle up to 30 or 40 tons. The number of blows may be as high as three hundred per minute. Forging should not be carried on below a dull red heat.

Thick heavy masses of steel which need mechanical work may be preheated to rolling or forging heat and then shaped on hydraulic presses, where the effect of the work is deeper than in rolling or forging.

The firms whose advertisements are found in this magazine are live, progressive leaders in the metal-working industry. If you need tools or equipment buy from the leaders; patronize those who are represented in these pages—and mention MODERN MACHINE SHOP. You will benefit by it.

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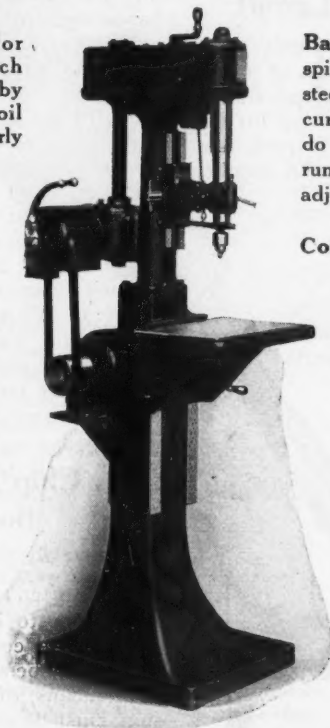
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Counterbalanced Elevating Table. The elevating table is of the quick-acting counterbalanced type, with perfectly scraped slide gibbed to the pedestal. Handle at front of machine for clamping.

Counterbalanced Head. The head is gibbed to the dovetailed slide on the column, and is counterbalanced to prevent dropping when unclamped.



THE FOSDICK MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.

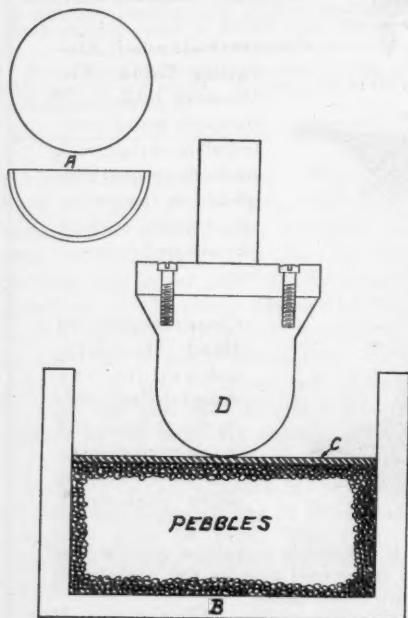
Ideas From Readers

This department is a clearing-house for ideas. If there is a "kink" or short-cut in use in your shop, send in a description of it. We will pay \$5 for each one published.

A Pebble-Forming Die

By CHARLES KUGLER

AMONG the jobs that have come to our shop was one of forming a number of sheet metal stampings, the specifications calling for the pieces to be not only formed, but also "pebbled." The limited number



"Pebbling" sheet metal.

of the pieces settled the question of an expensive die immediately, and we finally made up the outfit shown in the illustration, which did very well.

The pieces are indicated at A. The die, B, was an old cast steel pack-hardening box partly filled with clean pebbles upon which the work C was laid. As the punch D was forced down into the pebbles, the pebbles crowded up around it and formed the sheet metal to the shape of the punch, at the same time producing the "pebbled" effect in the metal. Practically the only cost was the cost of the punch. Practically any shape of punch can be used and any shape can be formed excepting those having square corners. When the metal to be formed is thin, wax can be used in the box as the sheet metal will take the form of the punch.

A Chip Guard for the Boring Mill

By J. E. MAYHALL

WE often have several different jobs to be done on the boring mill in the course of a day, any of which may be steel, brass, or cast iron. This means, of course, that the shavings must be cleaned up between jobs. In order to reduce the non-productive time as much as possible, we had a guard and a trough made for the machine, the guard to prevent the shavings from falling on the floor, and the trough to catch and hold them. The guard, indicated at A in the illustration, is made of sheet steel, reinforced around the top edge, and with the bottom edge cut, lapped and rivet-

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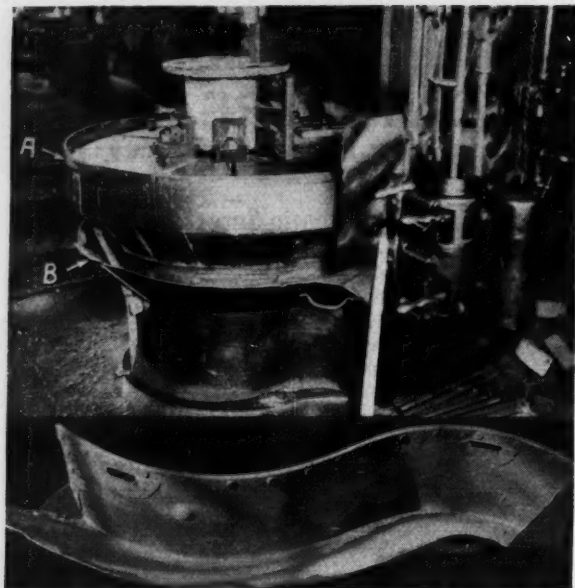
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(Above)—(A) This guard catches all shavings and drops them into the trough below. (B) The trough, which is made in two sections. (Below) Section of the trough.

ed as shown so as to allow the chips to drop into the trough. Ordinary pin-hinges hold the ends of the guard to the frame of the machine, and allow it to be moved up and down. When the machine is in operation, the guard is held up by a support that is hinged to the front of the base of the machine, the upper end of this support lodging under a sheet metal projection on the guard. A weight attached to the hinged support keeps it in position and when the operator wants to let the guard down in order to get at the table or bolts, he simply kicks the lower end of the support, dislodging it from the projection and allowing the guard to drop.

The trough is made in two pieces, one of which is shown in the lower part of the illustration. To place in position, the slots in the inner wall

of the section are slipped over lugs that are attached by means of screws to the side of the machine. The guard catches all chips and shavings and drops them into the trough, and the trough can be cleared almost instantly by dumping the shavings into a receptacle. The outfit saves a great deal of time and keeps the floor clean.

Gauge for Setting Crank Arms on Valve Gears

By J. H. HAHN

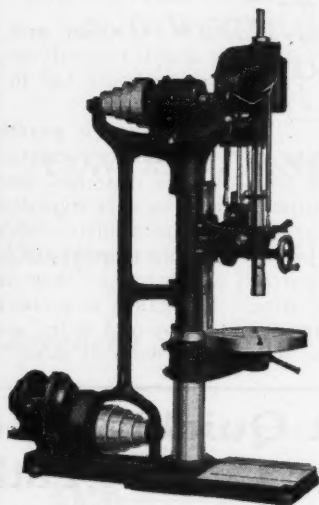
THE photograph shows a handy and useful gauge for setting eccentric crank arms of the Baker and Walschaert locomotive valve gears. To secure the proper steam distribution on a locomotive it is necessary that



Valve Gear Crank Arm Gauge

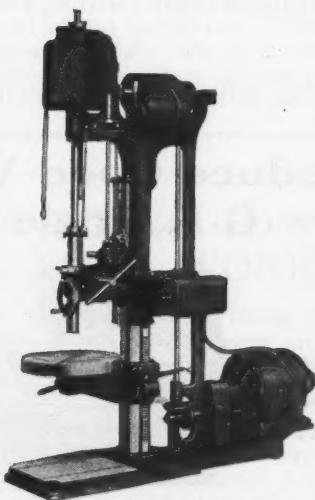
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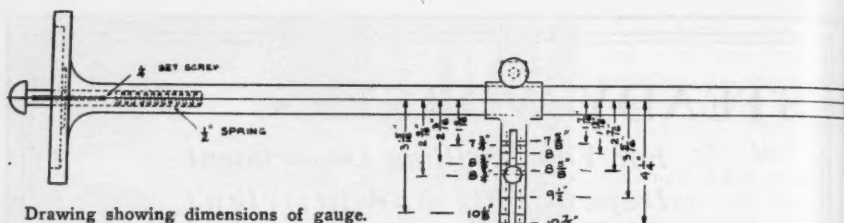
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Drawing showing dimensions of gauge.

the valve be set correctly, and one of the first things that should be checked is the correct location of the eccentric crank arm on the main crank pin. This gauge was designed to aid in checking the throw of these arms.

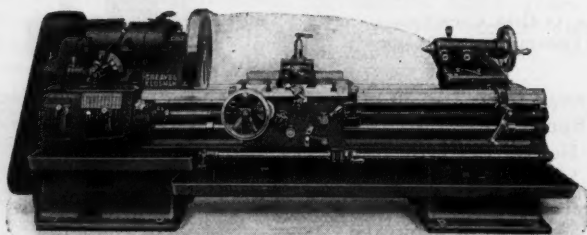
The crank arm is placed on the pin in approximately the correct position, the gauge is placed in the center of the axle of the main driving wheel, and with the pointer set for the throw for the particular class of engine being checked, a center is placed in the center of the boss or pin on the

end of the crank arm. If the arm is properly set, the pointer should fall in this center.

The gauge is graduated to take all the various classes of crank arms and the class and amount of throw of all classes are stencilled on the barrel that the pointer slides in. The pointer is secured by the set screw and notches which can be seen in the illustration. The gauge is useful both in the machine shop and in the round-house where this work is done.

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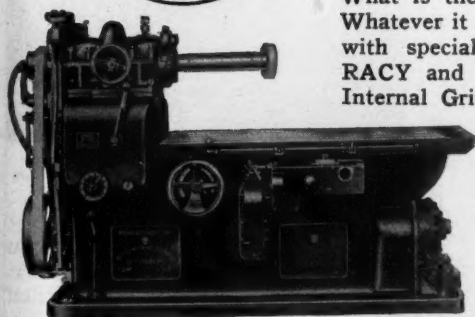
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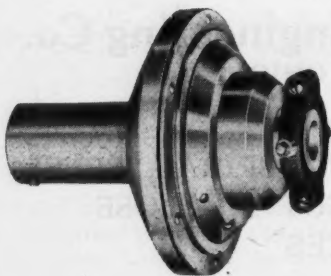


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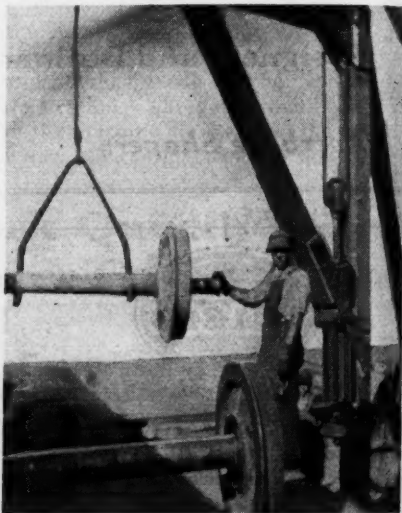
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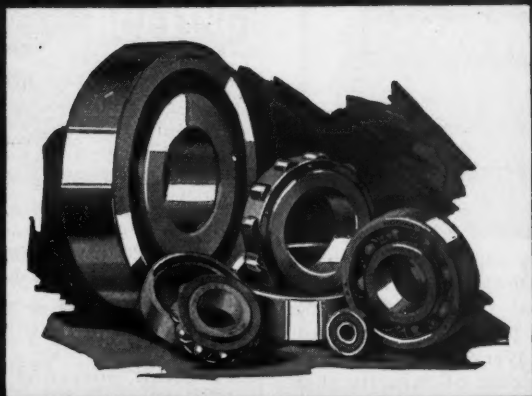
By JOS. C. COYLE

IN loading car wheels into cars at the shops of the Denver & Rio Grande Railway at Denver, it was found that the usual method of suspending the air hoist from the overhead arm of the boom cut down the lifting range too much for use. The necessary range was obtained and the power of the hoist was increased as well by mounting the air cylinder on the upright post of the boom, with the piston rod at the upper end. An



Attaching the air-hoist to the post, bottom end up, increases the head-room.

eight-inch pulley was attached to the piston rod, with a similar pulley at the end of the arm, and the cable was attached at the top of the vertical post. The cable was passed down around the pulley on the piston rod, back over a pulley at the top end of the post, then out over the pulley at the end of the arm. This increased the head-room by several feet.



EACH YEAR sees a substantial increase in the number of machinery manufacturers who, building their business upon the performance records of their product, find that the PRECISION distinctive of "NORMA" Ball and "HOFFMANN" Roller Bearings is a large factor in longer machine life, improved performance, greater customer satisfaction.

NORMA-HOFFMANN BEARINGS CORPORATION

Stamford, Conn., U. S. A.

NORMA-HOFFMANN

PRECISION

BALL BEARINGS

ROLLER BEARINGS

MODERN Machine Shop

Published Monthly at
128 Opera Place, Cincinnati, Ohio

By

DON G. GARDNER - - - Publisher
HOWARD CAMPBELL - - - Editor

Full Steam Ahead

THE latest reports relative to business conditions throughout the country indicate that 1929 will be a record year for business of all kinds. All the principal farm products are now on a good price basis, steel mill operations are averaging a considerably higher per cent of capacity than was the case a year ago, the automobile industry has swung back into its full stride, and the mechanical trades are reporting a shortage of skilled workers. Employment at the automobile manufacturing centers is larger than in any previous January. This country is now producing 57 per cent of the world's machinery, of which a considerable portion is being sold in foreign countries. Don't "sell America short."

Think!

HOW many of us really think? Doing a thing after one has been told how to do it is not thinking; doing it the way some one else has seen to do it is not thinking; nor does thinking consist in following orders somehow, blunderingly, in the hope that the doer will be near enough right to escape censure. Training—however obtained—is essential, but a college education is not necessary before a man can use his mind efficiently; the man who has convinced himself that his lack of a university education has doomed him to stay at the bottom is beaten before he starts.

Walter Dill Scott says: "Education is not a thing apart from everyday life. Education is profiting from experience, whether that experience is obtained or gained at the pupil's desk, the mechanic's bench, or the statesmen's table."

One of the most brilliant thinkers who ever lived made some remarks concerning the uses of education which could well be pondered by the holder of a degree and the grammar school graduate alike. This man was Henry George, who said in his "Progress and Poverty:" "As to the effects of education, it may be worth while to say a few words specially, for there is a prevailing disposition to attribute to it something like a magical influence. Now, education is only education in so far as it enables a man to use more effectively his natural powers, and this is something that what we call education in very great part fails to do. I remember a little girl, pretty well along in her school geography and astronomy, who was much astonished to find that the ground in her mother's back yard was really the surface of the earth, and, if you talk with them, you will find that a good deal of the knowledge of many college graduates is much like that of the little girl. They seldom think any better, and sometimes not so well as men who have never been to college."

The shop executive can accept the statement of this brilliant, educated man as conclusive evidence that any man can climb as high as his native ability and determination will carry him. At least half of the great things that have been done were the products of the minds of men who obtained their training outside of college. Many a scientific fact has been brought to light or invention developed by a man who didn't know enough to know that it couldn't be done.



THEY make any buffing operation smooth and continuous without loss of time. They eliminate all disadvantages of rag-buffs. They speed output, do better work and cut costs in half. Removal and attachment of abrasive cloth takes only 30 seconds. Entire assembly delicately balanced, preventing chattering. Every square inch of buffing surface brought into action.

Absolutely safe at high speeds. Tested at 8,000 R. P. M. and thoroughly guaranteed. A special feature is our patented metal clip which holds the ends of abrasive strips together, permitting speedy application and allowing ten per cent saving of material. Adopted by hundreds of factories all over the country for economy, safety and speed.

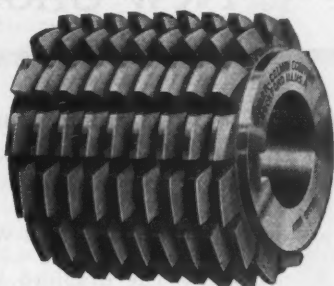
Write For Complete Details

This buffing system quickly pays for itself. Write immediately for bulletin and prices. Investigate this remarkable buffing system without delay.

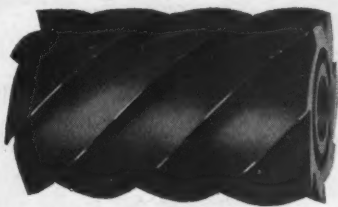
C. B. HUNT & SON
639 McKinley Ave., Salem, Ohio

SERVICE
Is Our Motto

QUALITY
Our Creed



GEAR HOBS
and
"BETTER CUTTERS"



by
**BARBER-
COLMAN**
of
ROCKFORD

THESE Small Tools are built for long hours of steady use... to stand the battering of a heavy feed and emerge triumphant... to hew steadily to the limit line beneath a chattering mountain of chips... Quality to the core... strength and sturdiness ever dependable.

**BARBER-COLMAN
COMPANY**

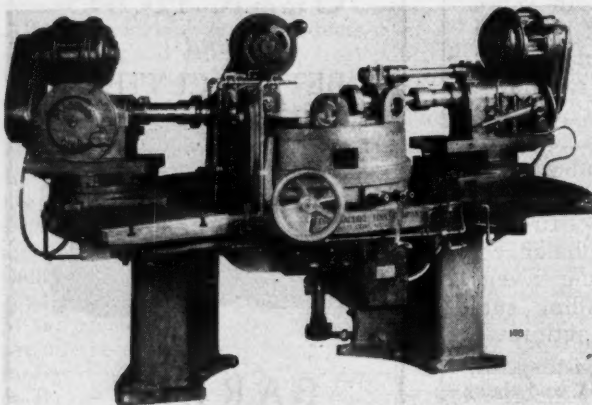
General Offices and Plant—Rockford, Ill., U. S. A.

New Shop Equipment

Bradford 3-Way Drilling and Tapping Machine for Aviation Engines

The illustration shows a 3-Way Drilling and Tapping Machine which has been built by The Bradford Ma-

rough bore, using multi-diameter boring tools, maximum diameter 2.274-inch; No. 2, at the back of the machine, finish bore, using multi-diameter boring tools, maximum diameter 2.290-inches; No. 3, at the operator's left hand, tap 2/38-inch thread. The material in this case is nickel aluminum alloy.



Bradford 3-Way Drilling and Tapping Machine for Aviation Engines

chine Tool Company, 659 Evans Street, Cincinnati, Ohio, for use in machining crank cases for "Wright Whirlwind" aviation engines. The fixture on this machine is provided with a triple index control and each unit is mounted on a swivel type mounting block in order to permit the necessary adjustments as required to produce the 5, 7 and 8 cylinder crank case on the same machine. Each unit is controlled independently from the hand valves on the front of the machine, performing the following operations: No. 1, at the operator's right hand,

In the operation of the machine, one part is locked in the fixture. By tripping the hand valve at the left, unit No. 1 is caused to operate. The fixture is then indexed to the next station, and the operator trips hand valves connecting units Nos. 1 and 2, performing the rough boring and finish boring operations on the second cycle. The fixture is then indexed to the third station and the operator trips the three hand valves operating all units for rough boring, finish boring and tapping. These cycles are repeated until all operations have been completed. The duplex system is provided for the distribution of cutting lubricants, flooding the boring tools with kerosene and the taps with lard oil. Actual boring time for a single cycle is 22 seconds. The floor-to-floor time for the five-cylinder crank case is four minutes; floor-to-floor time for the seven-cylinder case is five minutes, and floor-to-floor time for a nine-cylinder case is six minutes.

The Greatest FRICTION CHUCK

ever designed. **GUARANTEED** to eliminate tool breakage and increase production for tapping, deep hole drilling, reaming, stud and nut setting.

Multiple Disc Drive—No Parts to Wear Out

Tap held in free-floating collet insuring true tapped holes. Both tap and collet driven by the square.

For use on

Drill presses and radials.
All makes of tapping machines.
Electric and air tools.
Hand screw machines.

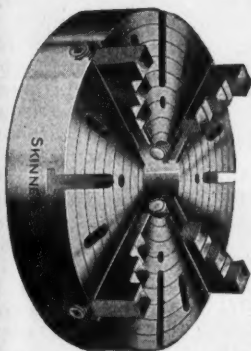
Send for our new Catalogue No. 5 describing

Quick change drilling and tapping chucks for single and multiple spindle operations, both positive and friction drive.

The APEX MACHINE CO. 305 DAVIS AVE.
DAYTON, OHIO



"Hard Labor for Life"



is the sentence when a chuck goes into service. The hardest part of the job on any machine falls to the chuck. Under the heaviest cuts, the chuck must be able to "stand the gaff" day after day without failure in any part.

That is why

SKINNER CHUCKS

are specified when strength and durability are necessary.

Send for Illustrated Catalog.

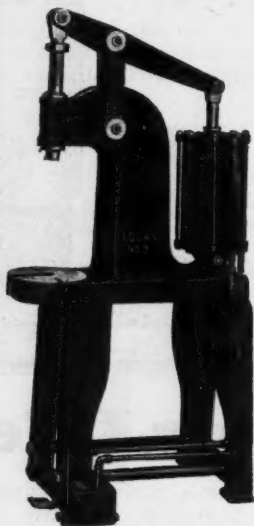
THE SKINNER CHUCK COMPANY
NEW BRITAIN, CONN., U. S. A.

"LOGAN"

Standard No. 3

AIR-OPERATED

Arbor Press



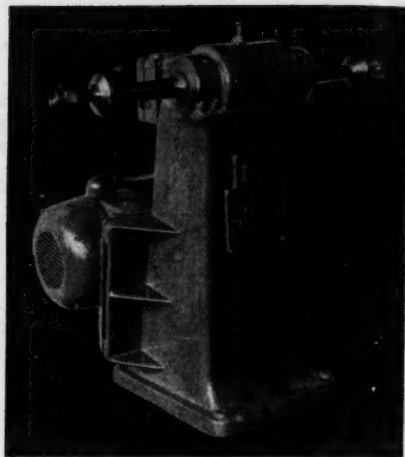
**Saves Time
Saves Labor
Increases Production**

Made in 10 Sizes

This is one of a complete line of Air-Operated Work-Holding Devices described in our

Catalog R-23
Ask For It!

LOGANSPORT MACHINE CO.
LOGANSPORT, IND.



Gardner No. 3-CB Polishing Lathe

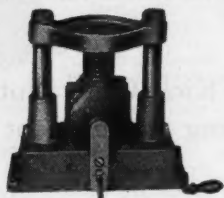
Gardner Single Spindle Polishing Lathe

A new single spindle polishing lathe—the No. 3-CB—has been added to the line of machines made by the Gardner Machine Company, 428 East Gardner Street, Beloit, Wis. This machine embodies a number of unique advantages, such as ability to obtain any desired spindle speed with A. C. motor drive; the use of the V-type multiple drive; great rigidity; compactness; and convenience of operation. The spindle is driven through V-type multiple belts by a motor mounted on a bracket that is cast integral with the machine base making a compact, floor-space-saving design. Adjustment for varying belt lengths is provided and in case of belt breakage, replacement can be made in a few minutes and without disturbing the spindle. Belts and sheaves are completely enclosed. Any desired spindle speed may be obtained by using sheaves of proper diameter.

The spindle is large with $2\frac{3}{4}$ -inch bearings and $1\frac{1}{4}$ -inch arbor, to take polishing wheels up to $3\frac{1}{2}$ -inch thick. A double roll Timken adjustable bearing is used in each end, mounted in

QUICK CLAMPING

—speeds production schedules where SIEWEK JIGS are used



Keeping up production schedules demands fast acting drill jigs, drill jigs that clamp and release in a hurry, without back pressure.

SIEWEK DRILL JIGS permit extra fast operation, drilling several parts in one jig, drilling right and left hand parts in the same jig.

Write today for details of the new SIEWEK Rapid Drill Jigs. They're money savers!

THE SIEWEK TOOL & DIE COMPANY
10230 Woodward Ave. Detroit, Mich.

TWENTIETH CENTURY BALANCING TOOL



Always
on
the
level

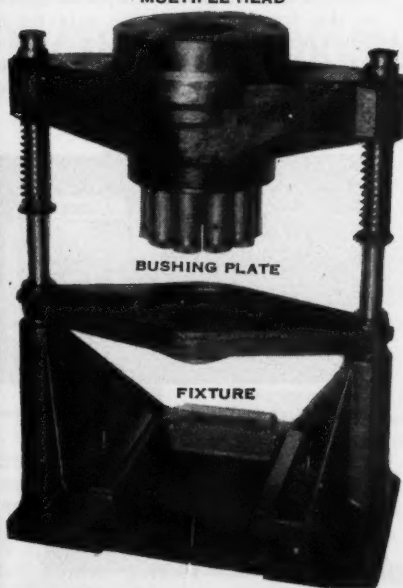


The most practical, sensitive and inexpensive device manufactured for balancing pulleys, cones, armatures, fly wheels, polishing wheels, etc. Will set anywhere and is easily portable. In sizes up to 24,000 pounds capacity.

Ask for the Bulletin

Sundstrand Machine Tool Co.
ROCKFORD, ILL.

MULTIPLE HEAD



BUSHING PLATE

FIXTURE

Why Guess About
Methods and Cost
of Increased Production

"Krueger"

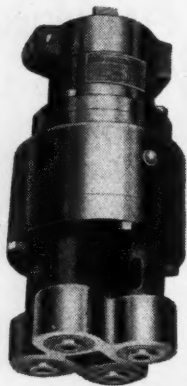
STANDARDIZED

Multiple Head } held in positive
Bushing Plate } and perfect
and Fixture } alignment for
Drilling, Reaming, Boring, Tapping

OUR SKILLED TOOL ENGINEERS

Will be pleased to furnish complete data and submit quotations on the equipment best suited to your purpose.

H. R. KRUEGER & CO.
439 EAST FORT ST., DETROIT, MICH.



Multiple Units

From Single Drills

Designed to fit any type of drill press, a U. S. Drill Head converts any single spindle drill into a multiple unit quickly.

No time wasted making adjustments—spindles are fixed. Any number of holes, fifty if necessary, can be drilled as easily as one.

We will design a U. S. Multiple Drill Head to meet your individual requirements. Tell us your needs. Address

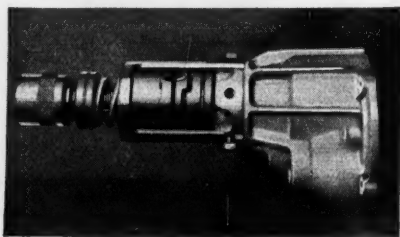
The United States Drill Head Co.

1954 Riverside Drive
Cincinnati, O., U. S. A.

a thoroughly dust-proof cartridge housing. The entire spindle assembly can be removed from the machine as a unit. The semi-projecting type of base, giving a slight overhang of the spindle, provides ample clearance across the front of the machine for any work.

Thor "Kick-Out" Nut Driving Attachment

A nut driving attachment that is designed to assure uniformity and accuracy in tension of nuts, prevent clutch breakage and wear, eliminate the breakage of studs and stripping of nuts, and to save the operator from fatiguing jolts, has been developed by the Independent Pneumatic Tool Company, 236 South Jefferson Street, Chicago, Ill. This tool is the Thor "Kick-Out" nut tightening adjustment with double slip clutch, shown in the illustration. This adjustment is provided with an auxiliary clutch which operates under spring tension when a given torque is applied to the front end of the attachment. When the nut is driven to this tension the auxiliary clutch disengages and lifts itself off on a cam which permits the front end of the attachment to



Thor "Kick-Out" Nut Driving Attachment

remain stationary for one revolution before the auxiliary clutch is again engaged, during which time the operator has ample opportunity to pull the machine away from the nut. This eliminates the jerking which takes



No. 2 Press

SHELDON ARBOR PRESSES

DESCRIPTION—Sheldon Arbor Press frames are made of semi-steel, the metal being properly distributed, giving a light and exceptionally strong casting. Rams and pinions are made of alloy steel, heat-treated. Large stub tooth is used. Rams are square, carefully fitted, insuring proper alignment.

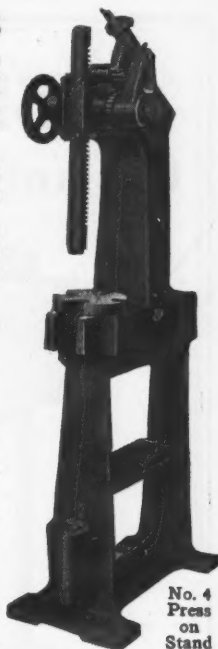
Nos. 1 and 2 presses are furnished only with plain levers. No. 3 presses are furnished either plain or ratchet levers. No. 4 presses only with compound levers.

Floor Stands can be furnished for our No. 3 and No. 4 presses. They are made of semi-steel, are well ribbed and of heavy construction. They are provided with removable shelves and wood pots for catching madrels, tools, etc.

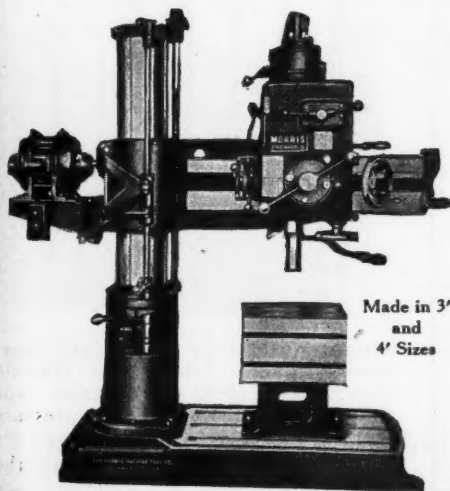
SHELDON MACHINE CO., 3251 Cottage Grove Avenue, Chicago

— SPECIFICATIONS AND PRICES —

	No. 1 Press	No. 2 Press	No. 3P Press	No. 3R Press	No. 4 Press	No. 3 Floor Stand	No. 4 Floor Stand
Largest dia. will take...	7"	12"	16"	16"	20"		
Largest dia. mandrel....	1"	1 1/2"	2 1/4"	2 1/4"	3"		
Height over plate.....	4 1/4"	8 1/4"	14"	14"	18 1/4"		
Max. height will take...	5"	9 1/4"	15"	15"	19 1/4"		
Size of ram (square)....	7 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"		
Length of ram.....	7 3/4"	13 1/2"	21"	21 1/2"	26"		
Movement of ram.....	6"	9 1/2"	15"	15"	20"		
Leverage.....	25 to 1	35 to 1	48 to 1	72 to 1	100 to 1		
Pressure on ram (tons)...	3/4	2	5	7 1/2	10		
Height.....	9 1/2"	17"	26"	26"	33 1/2"	35"	30"
Dimensions of base.....	4"x10"	6 1/4"x17"	8"x20"	8"x20"	8"x24"	14"x22"	14"x25"
Net weight.....	19 lbs.	75 lbs.	150 lbs.	215 lbs.	320 lbs.	145 lbs.	185 lbs.
Weight crated.....	20 lbs.	85 lbs.	170 lbs.	240 lbs.	360 lbs.	150 lbs.	195 lbs.
Price, F.O.B. Chicago....	\$10.00	\$20.00	\$30.00	\$40.00	\$75.00	\$20.00	\$30.00

No. 4
Press
on
Stand

MORRIS MOR-SPEED LUBRICATION



Made in 3'
and
4' Sizes

In addition to using hardened alloy steel gears, multiple splined shafts of alloy steel, multiple disc clutch and all geared drive, the entire head and back bracket runs in oil.

This is just another instance of employing modern machine construction to give longer and care free service.

The oil pump runs at constant speed and forces oil thru a sight feed oiler to reservoir at top of head from which all moving parts are lubricated by gravity.

Our bulletin "Mor-Speed" is full of modern construction details.

Write for one.



TIMKEN

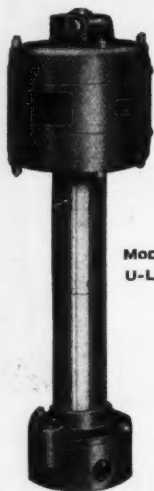
BEARING

EQUIPPED

**MORRIS MACHINE TOOL CO.
CINCINNATI, OHIO**

Represented by
**Pratt and Whitney Company, Agency Sales Dept.
Hartford, Conn.**

"GUSHER" Coolant Pumps



MODEL
U-L-O

For
EFFICIENT
and
ECONOMICAL
MACHINE TOOL
PRODUCTION

The Ruthman Machinery Co.

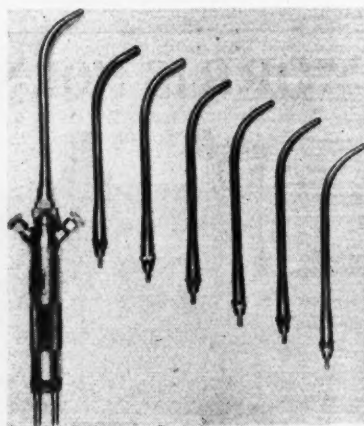
Front and Pike Streets
CINCINNATI

place in positive type clutch construction.

The Thor "Kick-Out" attachment is adjustable so as to take care of a variation of sizes of nuts and bolts. When the attachment is set and adjusted, every nut and bolt will be driven to exactly the same predetermined tightness regardless of the operator. The adjustment is made in several sizes, to drive nuts or bolts from $\frac{1}{8}$ -inch up to $1\frac{1}{2}$ -inch diameter. The attachment is very simple in construction and is enclosed by a sleeve extending over the two clutches which protects all moving parts from dust or grit.

Oxweld Aircraft Blowpipe

The Oxweld Type W-15 Aircraft Welding Blowpipe has been placed on the market by the Oxweld Acetylene Company, 30 East Forty-second Street, New York City. This equipment fills the need for a blowpipe

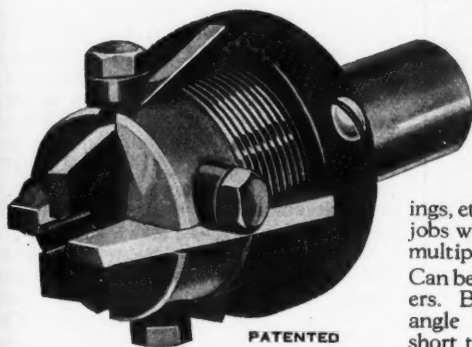


designed especially for aircraft fuselage welding. Like other Oxweld blowpipes it is of the injector type and can be used on a low pressure acetylene supply.

Welding heads, supplied with the blowpipe, seven in number, are

Genesee Adjustable Hollow Mill

Made in 7 different styles



PATENTED

Has adjustable, replaceable blades and can be replaced at nominal cost, making it unnecessary to continually buy new tools.

The ideal tool for finishing your forgings, castings, etc. Do your several operation jobs with Genesee inserted blades multiple operation tools.

Can be fitted with drills and reamers. Blades can be ground any angle to point work and turn short tapers.

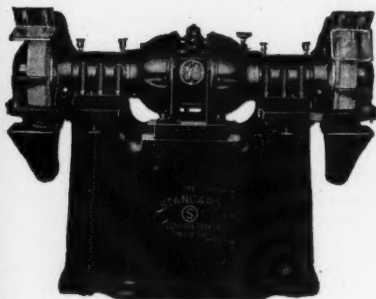
A Genesee Adjustable Hollow Mill can be made for every job

WRITE FOR CATALOGUE

GENESEE MANUFACTURING CO., Inc.

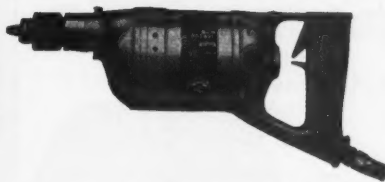
ROCHESTER, NEW YORK

Standard Ball Bearing Electric Drills, Grinders, Polishers and Buffers



HEAVY DUTY GRINDER

G. E. 40 Degree Motor and Push Button Control. Four S. K. F. Ball Bearings. Nickel Steel Armature Shaft. Made in 5, 7½ and 10 H. P. sizes.



GENERAL ELECTRIC UNIVERSAL MOTOR DRILLS

G. E. Universal Motor, S. K. F. Ball Bearings. Gears made out of chrome-nickel steel and run in grease. Trigger switch. Made in ¼", 5/16", ¾", ½", ¾", ¾", 1" and 1¼" capacity in steel.

Write for Late Catalog

THE STANDARD ELECTRICAL TOOL CO.

ESTABLISHED 1912

CINCINNATI, OHIO

"HOPKINS"
PREFERRED
EQUIPMENT

Air Chucks

for Profitable Production!

SECURE greatest efficiency, utmost accuracy and top speed by the use of "HOPKINS" Chucks.

Dustproof—they are practically trouble-free in operation.

Jaws are all hardened ground.

Bell crank for operating chuck is a one-piece drop forging.

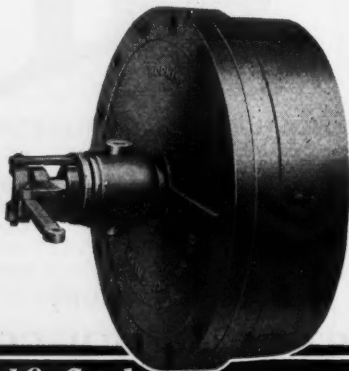
Face plates are fastened to the chuck body with socket-head, heat-treated screws. They are doweled with taper dowels and in case of wear can be removed and enough stock ground off on the surface grinder to take care of the wear.

Write for Bulletin giving full data on
"HOPKINS" Air-Operated Chucks,
Valves and Cylinders.

THE TOMKINS-JOHNSON CO.

620 MECHANIC STREET
JACKSON, MICH., U. S. A.

Also Manufacturers of Chucks, Die
Sinking Milling Cutters, Work Stands,
Special Equipment, Etc.



Send for Catalog

equipped with drawn copper tips to withstand high temperatures, curved to reach with ease the most inaccessible places encountered in aircraft welding. Each welding head is detachable as a unit and each injector can also be detached from the welding head and replaced if necessary. The welding head is connected to the body of the blowpipe with a double conical seat and is held in place with a knurled head nut. This nut is designed to be tightened by hand, but is also provided with faces so that a wrench can be used for loosening it if necessary.

The Type W-15 Blowpipe is of sturdy construction to withstand any usage to which a blowpipe is subjected in this kind of work. The handle is knurled to provide a good grip. The $\frac{1}{4}$ -inch oxygen and acetylene hose are connected directly to the blowpipe, the usual screwed hose connections being dispensed with. Valves for adjustment of oxygen and acetylene pressure are placed on the handle in such a position that they can be operated by the thumb and forefinger of the hand holding the blowpipe, leaving the other hand free. The various welding heads are all designed for a constant oxygen pressure of twenty pounds per square inch, making it possible for the welder to change the heads without changing the adjustment of the oxygen regulator.

This blowpipe is extremely light, weighing slightly over nine ounces with the largest tip attached. The center of gravity lies near the middle of the blowpipe so that correct balance is maintained when the hose is attached. Although primarily designed for aircraft use, this blowpipe is also well adapted to work of all kinds on light tubing or sheet metal.

"U. S." 6-Inch Grinder

A new 6-inch grinder that is said to give promise of being one of the most popular in the "U. S." line, is now being announced by The United

Build
an a
ever
diam
beari
pulle

Use the Big Lamps Where and When You Want Them

with the

Levolier

Heavy Duty Fixture Switch

Get a full measure of convenience, efficiency and economy from your lighting system. Install the Levolier Fixture Switch in outlet box, canopy or ceiling pan and control each unit individually. Away from the heat of the lamp, the switch will last indefinitely.

Rebuilt, of heavier section, eliminating possibility of breakdown. With a rating of only 6 amperes, this switch will take the initial 45-ampere smash of switching a cold 500-watt gas-filled lamp.

Easy to install. Skin and loop one leg of circuit and attach the two ends to the terminals of the switch.

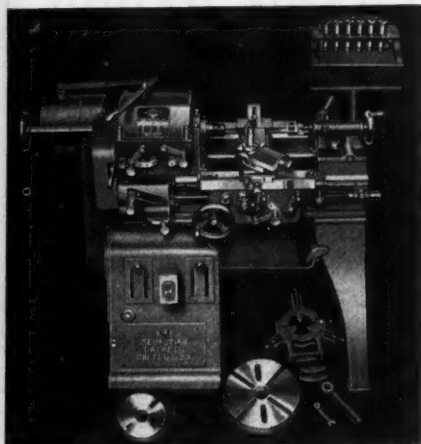
Get them from your jobber or let us send a sample

McGILL MANUFACTURING CO., VALPARAISO, IND.



THE SMALL LATHE you have been looking for!

SIZES 11" TO 20" SWING



POWERED far beyond its apparent size, generously proportioned and equipped with a completeness unequalled in its field, the

11" Gold Seal Heavy Duty Precision Tool Room Lathe

offers the manufacturer a long needed addition to his lathe equipment.

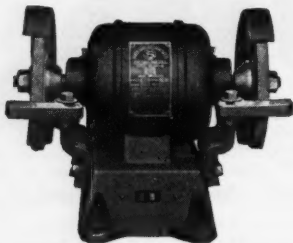
The time saving convenience, precision and versatility of this machine will reduce the cost of producing a wide range of parts—much work can be handled with it that formerly had to be done upon a larger machine.

All details sent upon request

Built for heavy cuts and fast work, yet aligned with an accuracy of .0005". Graduations are provided at every point. The hole through the spindle is 1-5/16" diameter, and the lathe takes collets up to 3/8". All bearings are oversize. Made in motor and single pulley belt-driven models.

THE SEBASTIAN LATHE COMPANY
900 Culvert Street Cincinnati, Ohio
New York Address: Room 372, 50 Church St.

States Electrical Tool Company, 2471 West Sixth Street, Cincinnati, Ohio. The design of this tool embodies ball bearings of a widely known make, heavy nickel steel spindle, a powerful $\frac{1}{4}$ -h. p. motor of 3,450 r. p. m. load speed, a fine and a coarse wheel $6 \times \frac{1}{2} \times \frac{1}{2}$ -inch, adjustable tool rests



"U. S." 6-inch Grinder

and complete electrical connections. The grinder is furnished regularly for 110 volt, 60 cycle current from light socket. However, it can also be furnished in 220 volt, two and three phase, also in 110 and 220 volt direct

current at slightly additional cost. The grinder lists at \$34.50.

CO-OPERATION PAYS!

The firms whose advertisements are found in this magazine are live, progressive leaders in the metal-working industry. If you need tools or equipment buy from the leaders; patronize those who are represented in these pages—and mention MODERN MACHINE SHOP. You will benefit by it.



GEARS

All Kinds—Small—In Stock

The most accurate made and prices reasonable. We carry a complete line of gears in stock for immediate shipment. Can also quote on special gears of all kinds. Send us your inquiries.

Write for Catalog 80

CHICAGO STOCK GEAR WORKS
105-9 S. Jefferson St. Chicago, Ill.



GRAND RAPIDS UNIVERSAL CUTTER and TOOL GRINDERS

Meet all Requirements

(Built in 5 sizes)

Motor Driven — Belt Driven
Power Feed—Hand Feed
Wet Grinding—Dry Grinding
Convenience—Rigidity
Self Contained Motor Drive

Bulletin on Request

GALLMEYER & LIVINGSTON CO.

348 Straight Ave., S. W.
GRAND RAPIDS, MICH.

PROCUNIER



SAFETY TAPPING ATTACHMENT with the "Procunier" Safety Friction and "Double-Jaw" tap holder gives

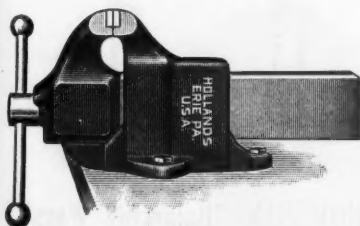
GREATER ACCURACY and LESS TAP BREAKAGE

The Procunier Safety Friction Device is very easily adjusted. With it blind holes can be tapped just as easily as through holes, and without danger of breakage.

Catalogue 102-C gives complete details of **PROCUNIER Tapping Devices, Quick Change Chucks, Stud Setting Tools and Bench Tapping Machines.**

PROCUNIER SAFETY CHUCK CO.
12 So. Clinton St. Chicago, Ill.

HOLLANDS VISES



A line of individuality and merit, that is the result of over forty years of concentrated effort to produce Vises that will meet the most severe service demands.

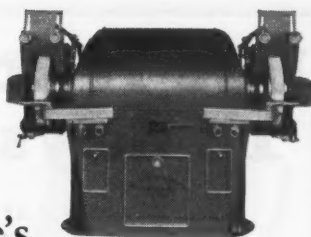
Strength, rigidity and durability are the three qualifications that have been attained by good design, workmanship and manufacturing facilities.

Write to us for prices and catalog

HOLLANDS MFG. CO.

Established 1887

344 E. 18th St. Erie, Pa.



Here's
a Grinder that's
FOOL PROOF

HERE'S the "Rite-Speed" Grinder... fast, safe and actually fool proof. A Grinder which will smooth out production tangles, reduce costs, stop delays and increase your profits.

Exclusive Advantages

Protected by Basic Patents

But more than that... it is a grinder which will pay for itself through savings in abrasive wheels and by preventing inefficient operation. For as the abrasive wheels wear down, the rotative speed should be increased to maintain the peripheral speed. With the "Rite-Speed" Grinder this change is automatically enforced. The motor stops and it cannot be started until the change in speed is made. Thus it is possible to maintain the highest grinding efficiency and at the same time use practically the entire abrasive wheel. It is also impossible to run a large wheel at an "overspeed."

Send for Full Information

Let us send you more detailed information about the "Rite-Speed" Grinder. Learn all about its many advantages. Investigate its money-saving possibilities. Just pin the coupon below to your letterhead. Do it now... while you're thinking about it.



The Safety Grinding Wheel & Machine Co.

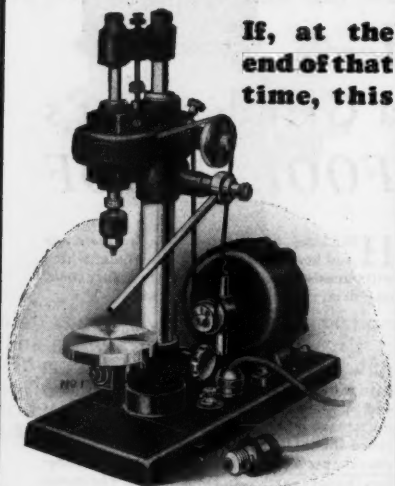
2334 Columbus Ave., Springfield, Ohio, U. S. A.

Please send me bulletin F-28-3 regarding your "Rite Speed" Grinders.

(Name of Individual)

Pin this to your letterhead

Use it for 10 days!



If, at the
end of that
time, this

"A. M." Sensitive Drilling Machine

has not given entire satisfaction, or has been found in-adaptable to the work, it may be returned at our expense.

All we ask is that you send blueprint or sample of work so that we can determine adaptability and size of machine required.

Ask Us For "An Outline of
Economical Small Drilling."

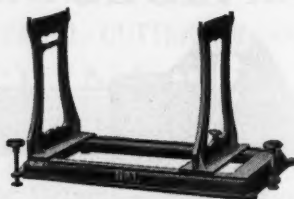
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Use the Right Wheel for Economy

A grinding wheel is made of two materials—the "grains," which do the cutting; and the bond, which holds the grains together. The "grain" and "grade" of a wheel refer to the size of the grains and the hardness of the bonding material. When the bond allows the grains to wear away before they have become dulled, the wheel is too soft. When the bond holds the grains after they have become dulled, the wheel is too hard. A wheel that is too soft for the job wears away rapidly; a wheel that is too hard becomes glazed, resulting in slow cutting, a poor job, and heating of the work. If the correct wheel is not available, it is better to use a wheel that is too soft than one that is too hard.

For Sure Balance—

an absolutely level and solid "Way" is necessary



BOWSHER "Balancing Ways"

are brought to an absolute level in ten seconds. No revolving parts.

The edges or "knives" upon which the work is tested are ground true, and are mounted upon the planed "ways" of a heavy bed or frame.

Standards adjustable to suit length of arbor.

Three sizes for floor—one for bench use

Send for Catalog "H"

The N. P. Bowsher Co., South Bend, Ind.

Now an Improved Rapid Drop-Forged Steel Clamp!

THE new double-tooth trigger gives the tool added strength and power. Will withstand the hardest usage.

No time wasted turning the screw. Pull the trigger, set the ram up to the work, then give the screw a turn to obtain the necessary pressure. Unequaled for

Speed :: Power :: Rigidity

Made in 6" and 8" sizes. New light 4" clamp ready for delivery soon.

Quality throughout. Every clamp warranted

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Note the
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trigger

"Lehmann Lathes"

TWO STYLES
Three Step Cone
and 16-Speed
Geared Head

5 SIZES

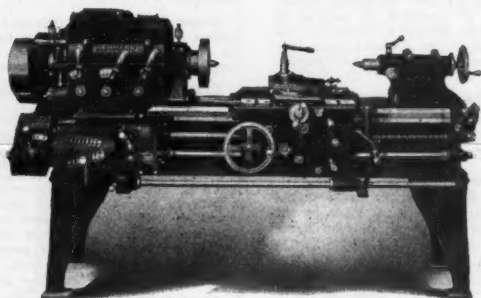
16/18 1/4"

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20/22"

22/24 1/4"

24/27 1/4"



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the most modern ideas in design and construction. Their performance is their best endorsement.

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Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than ten.

Turret Lathes and Tools: Illustrated book describing Cincinnati Acme Turret Lathes and Screw Machines, and showing a variety of tools and fixtures for use with these machines. The Acme Machine Tool Co., 4953 Spring Grove Ave., Cincinnati, Ohio.

Broaching By Modern Methods: Equipment and tools for finishing round, square or irregular-shaped holes and surfaces by broaching are described and illustrated in a booklet that is issued free by the American Broach & Machine Co., Ann Arbor, Michigan.

Scraping By Power: Bearing surfaces can now be scraped with a power scraper that is quicker and easier than the old-fashioned hand method. The tool is described in a folder that is issued by Anderson Bros. Mfg. Co., 1926 Kishwaukee St., Rockford, Ill. Sent free on request.

Steel Furniture for the Shop: The complete line of steel furniture made by the Angle Steel Stool Co., Plainwell, Michigan, including steel stools and chairs, steel foremen's desks, lockers, tables, tool stands, machine tenders, shop boxes and pans, iron bar racks, trucks, bench legs, and bench drawers, is described and illustrated in Catalog "C," which is issued free to machine shop executives.

Stop Tap Breakage: A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by The Apex Machine Co., 200 Davis Ave., Dayton, Ohio. Sent free upon request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

Hobs and Milling Cutters: A complete line of milling cutters and hobs for cutting all kinds of gears, splines, sprockets and other forms is described in Catalog G, issued by the Barber-Colman Company, Rockford, Ill. Descriptions and illustrations of the Barber-Colman hobbing machine and hob-sharpening machines are included. Sent free on request.

All-Geared Drilling and Tapping Machines: A catalog describing in detail the various types of all-geared, self-feeding, drilling and tapping machines made by the Barnes Drill Co., 801-851 Chestnut Street, Rockford, Ill., will be sent free upon request.

Modern Drilling Equipment: Circulars describing the various types and sizes of Barnes upright drills, multiple drills and horizontal drilling machines made by this company have been issued by the W. F. & John Barnes Co., Rockford, Ill.

Automatic Oiled Die Sets: The automatic oiled die sets, die shoes, punch holders, leader pins, bolster plates, bushings, and other standard die parts made by the E. A. Baumbach Manfg. Co., 1806 S. Kilbourn Ave., Chicago, Ill., are described in Catalog No. 5, which has been issued by that company. Sent free upon request.

Bowsher Balancing Way: Gears, pulleys, fly-wheels, emery wheels, and other rotating parts should be properly balanced. This work can be done quickly and accurately on a balancing way that is described in a bulletin issued by The N. P. Bowsher Co., South Bend, Indiana.

Bradford Unit Type Drill Heads and Tapping Heads are described and illustrated in a bulletin published by the Bradford Machine Tool Co., 659 Evans Street, Cincinnati, Ohio. The bulletin also describes useful applications of these heads.

Bradford Precision Lathes: Precision Lathes for the tool room and for general manufacturing purposes, all-geared and cone types, belt or motor driven, are described and illustrated in a catalog that is issued by The Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio. The catalog also includes descriptions of taper, relieving, turret and other lathe attachments. Sent free upon request.

How to Sharpen Cutters: A series of leaflets, which describe and illustrate the correct methods to employ in sharpening all kinds of cutters, can be obtained, without charge, by addressing Brown & Sharpe Mfg. Co., Providence, R. I.

Gears of All Kinds are described and illustrated, with specifications, in Catalog 80 which has been issued by the Chicago Stock Gear Works, 105-9 S. Jefferson St., Chicago, Ill. Copy sent free on request.

Drilling Machinery: Circulars describing all types and sizes of radials, uprights, and gang drills for every class of work may be had by writing to The Cincinnati Bickford Tool Co., Oakwood, Cincinnati, Ohio.

Gear Data: The Cincinnati Gear Co., Cincinnati, Ohio, has published Catalog D, which describes and illustrates the various types and kinds of gears made by this firm. The book contains photographs of the plant departments, with descriptions of the equipment employed, and also includes a number of pages of valuable data and reference tables for machine shop use.

Rapid Traverse Planers: Cincinnati Hypro Planers, made by the Cincinnati Planer Co., Cincinnati, Ohio, are described in a new catalog that has been issued by this company.

Shaper Progress: An illustrated catalog describing the various types of shapers made by the Cincinnati Shaper Co., Cincinnati, Ohio, and including descriptions of Cincinnati Shapers in use in different kinds of plants.

Cisco Engine and Tool Room Lathes, manufactured by the Cisco Machine Tool Co., 1765-69 Elmore St., Cincinnati, Ohio, are fully described in their catalog. This catalog also includes descriptions of their Radial Drill, Tapping Machine, and Special Attachments.

Handbook For Drillers: The Cleveland Twist Drill Co., 1242 E. Forty-ninth St., Cleveland, Ohio, has published a book in which the various parts of the twist drill are described, and which tells how to grind a drill correctly. The troubles that result from incorrect grinding are described and illustrated and several chapters are devoted to the subjects of speeds, feeds, materials, cutting compounds, and so on. Sent free upon request.

Inserted Blade Reamers: A new type of reamer with high speed steel blades, designed to reduce cutting costs and give longer service, is described in a bulletin that will be sent without charge upon application to the Conradson Tool Corporation, 2114 Indiana Ave., Chicago, Ill.

Disc, Expansion and Compression Clutches: The various types of clutches and their uses are discussed in an illustrated booklet that is issued by The Conway Clutch Co., 1959 West Sixth Street, Cincinnati, Ohio.

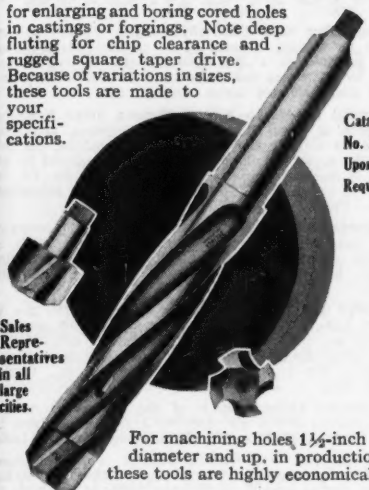
OTHER PUBLICATIONS LISTED ON PAGES 72 AND 74.

Two-Piece Core Drill

for enlarging and boring cored holes in castings or forgings. Note deep fluting for chip clearance and rugged square taper drive. Because of variations in sizes, these tools are made to your specifications.

Catalog
No. 28
Upon
Request

Sales
Representatives
in all
large
cities.



For machining holes 1 1/4-inch in diameter and up, in production, these tools are highly economical.

ECLIPSE INTERCHANGEABLE COUNTERBORE COMPANY
DETROIT — MICHIGAN

DETROIT SEMI-AUTOMATIC DRILLING MACHINES

Drills
900
to
1200
holes per
hour.

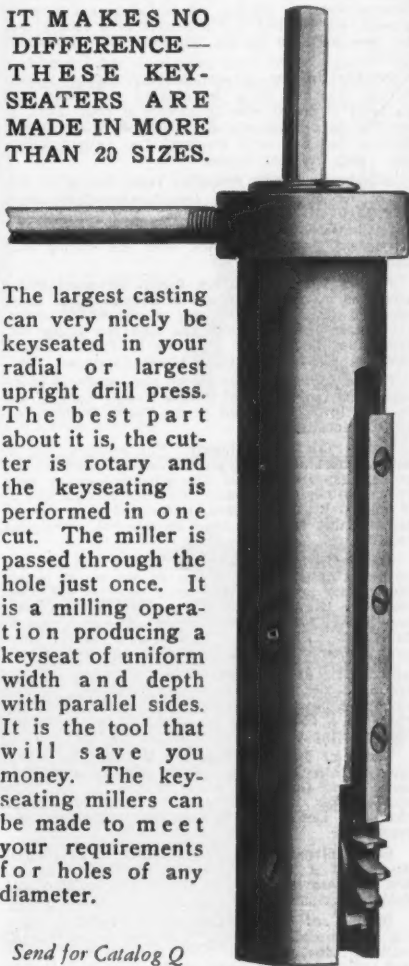
Capacity—No. 60 to 3/8-in. Drills. Standard Fixtures will handle round or hex. stock. Five spindles, cam control. Unsurpassed for speed, accuracy and low cost operation. Over 1800 in successful operation.



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5055 Woodward Ave., Detroit, Mich.

LARGE WORK SMALL WORK

IT MAKES NO
DIFFERENCE—
THESE KEY-
SEATERS ARE
MADE IN MORE
THAN 20 SIZES.



The largest casting can very nicely be keyseated in your radial or largest upright drill press. The best part about it is, the cutter is rotary and the keyseating is performed in one cut. The miller is passed through the hole just once. It is a milling operation producing a keyseat of uniform width and depth with parallel sides. It is the tool that will save you money. The keyseating millers can be made to meet your requirements for holes of any diameter.

Send for Catalog Q

National Machine Tool Co.
2271 Spring Grove Avenue
CINCINNATI, OHIO, U. S. A.

Die Makers' Supplies: A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Dandy Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Quantity Drilling: A semi-automatic multiple spindle drilling machine which is designed to produce the maximum of drilled holes in medium or small parts, is described in a pamphlet that is published by the Detroit Machine Tool Co., 5055 Woodward Ave., Detroit, Michigan. Sent free upon request.

Interchangeable High Production Tools: Catalog No. 28, issued free by the Eclipse Interchangeable Counterbore Co., 7410 St. Aubin St., Detroit, Michigan, describes and illustrates the interchangeable counterbores, spot facers, and form cutters, and other end cutting tools made by this firm.

Formica Silent Composition Gears: A booklet telling about the uses and advantages of Formica Silent Shock Absorbing Gears, and containing a considerable amount of valuable data with rules and tables for laying out, cutting and using gears. Sent free by Formica Insulation Co., 4632 Spring Grove Avenue, Cincinnati, Ohio.

Fosdick Drills: This publication gives details as to the design and construction of Fosdick Radial, Upright, and Sensitive Drills. Published by the Fosdick Machine Tool Co., Cincinnati, Ohio.

Modern Grinding Equipment: The complete line of universal tool and cutter grinders, surface grinders, drill grinders, tap grinders, and other grinding machines made by the Galmeyer & Livingston Co., 336 Straight St., S. W. Grand Rapids, Michigan, is described in a series of bulletins that have been issued by this firm. Free upon request.

Saving Time by Disc Grinding: A book that tells how production costs can be reduced by the use of modern disc-grinding equipment, and which describes and illustrates the latest types of machines used for this work, has been issued by the Gardner Machine Company, Beloit, Wis. A number of illustrations of jobs in operation, together with complete production data, are included.

Adjustable Blade Cutters: Hollow mills, facing tools, face mills, milling cutters and other production tools with adjustable, interchangeable blades are described and illustrated in a booklet that is issued free by the Genesee Manufacturing Co., 141 N. Water St., Rochester, N. Y.

Horizontal Boring, Drilling and Milling: The various types of horizontal boring, drilling and milling machines made by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., are described in a series of bulletins that have been issued by this firm. Sent free upon request.

Greaves-Klusman Lathes: A book containing complete descriptions of the latest types of lathes made by this firm has been issued by the Greaves-Klusman Tool Co., Oakley, Cincinnati, Ohio.

Drilling and Grinding Electrically: Catalog M, showing and describing a variety of modern electric portable drills, grinders, and other tools, including floor grinders and buffers, has been issued by The Hisey-Wolf Machine Co., Colerain and Marshall Sts., Cincinnati, Ohio.

Vises and Pipe Tools: The bench, machine and pipe vises, pipe cutting and threading tools, babbitt ladles and melting pots made by the Hollands Manufacturing Co., 344 E. 18th St., Erie, Pa., are described and illustrated in a booklet that is issued free by the firm mentioned.

"Quick-As-Wink" Buffing Wheels: that eliminate all disadvantages of rag-buffs, speed output, do better work, and cut buffing costs to the minimum are described in a bulletin that is issued free by C. B. Hunt & Son, 639 McKinley Ave., Salem, Ohio.

Assembling with Electricity: Light, portable electric tools for drilling, tapping holes, and for driving screws are described in a booklet which can be had without cost by addressing the Independent Pneumatic Tool Co., 236 South Jefferson Street, Chicago, Ill.

Special Mil-Waukee-Mits of Standard Units: A milling machine of which the base, heads, columns, and other parts are built in standard units, thus enabling the user to order a machine that will be especially adapted for his job, is described and illustrated in Catalog No. 36, issued by the Kearney & Trecker Corporation, Milwaukee, Wis. Free to machine shop executives.

Standardized Jigs and Fixtures: Information concerning standardized jigs and fixtures, also all kinds of special equipment for production, can be had by writing to H. R. Krueger & Co., 439 East Fort St., Detroit, Mich.

Cutter and Tool Grinding: A book that tells how to grind tools and cutters accurately and which also describes and illustrates the different types of LeBlond Universal Tool Room Grinders will be sent free upon request. Address, The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio.

Lehmann Lathes: Details of the outstanding features of Lehmann Lathes are given in a catalog published by the Lehmann Machine Co., 3560 Chouteau Ave., St. Louis.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Rapid-Reading Micrometer: A new type of rapid-reading micrometer, designed to show the reading in numerals, is described in Catalog No. 5, issued by The Lufkin Rule Co., Saginaw, Michigan. The catalog also contains descriptions of the micrometers, calipers, gauges, scales, squares, bevel protractors, and other tools made by this company. Free upon request.

Time Saving Machine Equipment: How machining time can be reduced to the minimum by the use of Wizard chucks, collets and tap holders, turret tool posts, self-centering steadyrests, and other McCrosky equipment is told in a book that is issued by the McCrosky Tool Corporation, Meadville, Penna. Will be sent without charge.

Lamp Guards: The various types and kinds of lamp guards made by the McGill Manufacturing Co., Valparaiso, Ind., for factory use are described in a catalog that will be sent free upon request.

Accuracy in Internal Grinding: The latest methods of producing accurately-ground holes are described in a booklet which also describes and illustrates the internal grinders made by the Micro Machine Co., Bettendorf, Iowa. Sent free upon request.

Roller Bearing Radial Drills: The application of Timken roller bearings in the design of modern radial drilling machines is discussed in a bulletin describing "Mor" Speed Radial Drills, published by the Morris Machine Tool Co., Cincinnati, Ohio.

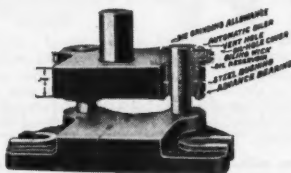
An Outline of Economical Small Drilling: The subject of small-hole drilling is discussed in a booklet that is published by Adolph Muehlmann, Fifth and Elm Sts., S. E., Cincinnati, Ohio. The booklet also describes the outstanding features in the construction of the A. M. Sensitive Drilling Machine.

"The 'Hole' Story in One Word" is the title of a publication that has been issued by The National Automatic Tool Co., Richmond, Ind. The book gives details as to construction and uses of "Natic" multiple drilling and tapping machines.

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Automatically Oiled

DIE SETS



Standardized die sets, embodying many exclusive features, and a listing of 70,000 stock sizes afford a service that is unsurpassed.

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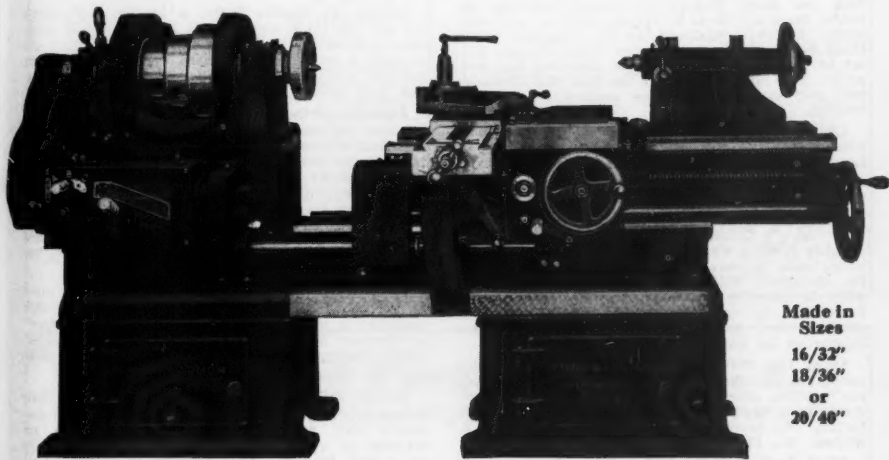
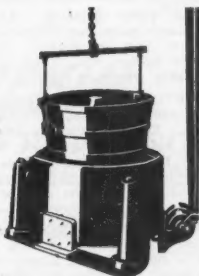
The Tolhurst Chip Wringer saves dollars in cutting oil by reclaiming the oil for use over and over again. Reclaims 6 to 15 gallons per load, 4 or more loads per hour. Basket sizes 20" to 48". Capacities 1 to 10 bushels.

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Sizes
16/32"
18/36"
or
20/48"

Rahn-Larmon 18/36" Extension Bed Gap Lathe

A lathe for large or small swing work, ready at all times. Requires no extra rigging up. Takes different distances between centers.

Belt driven or with nine speed all geared motor driven head. Tell us what your requirements are and let us quote you.

THE RAHN-LARMON CO.

2935 Spring Grove Ave., Cincinnati, Ohio

Milling Internal Keyways: A simple method of milling keyways in gears, wheel hubs, and other similar parts with the aid of a drill press and a special tool is explained in a booklet that is published by the National Machine Tool Co., 2271 Spring Grove Ave., Cincinnati, Ohio.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

Grinding Wheel Information: A booklet which tells how grinding wheels are made and graded, and which give instructions for mounting wheels, operating speeds for different kinds of work, instructions for truing and dressing, and other information has been issued by the Norton Company, Worcester, Mass. Sent free upon request.

Correct Cutter Grinding: How cutter costs can be reduced and more production per grind of cutter obtained is told in Booklet "E," published by The Osterlein Machine Co., 3319 Colerain Ave., Cincinnati, Ohio. Sent free upon request.

"Ohio" Shapers and Planers: The latest types of shapers and planers manufactured by The Ohio Machine Tool Co., Kenton, Ohio, are described and illustrated in a series of bulletins that have been issued by this firm. All the latest features of these machines, such as automatic lubrication, instantaneous feed, centralized control, and gear box, are described in detail. Free upon request.

Self-Tapping Sheet Metal Screws: Screws which are threaded and hardened in such a manner as to enable them to cut their own threads as they are screwed into sheet metal assemblies are described in a folder which is published by the Parker-Kalon Corporation, 192-196 Varick St., New York City, N. Y. Sent free upon request.

Tapping Devices, Quick-Change Chucks, Stud-Setting Tools and Bench Tappers: A catalog describing the various types and kinds of tapping, drilling, and stud-setting devices manufactured by the Proconer Safety Chuck Company, 12 South Clinton Street, Chicago, Ill., can be obtained without charge by addressing this company. The catalog also tells the part that Proconer tools play in obtaining greater accuracy and less tap breakage.

Engine, Turret, and Gap Lathes are described in a series of bulletins that have been issued by The Rahm-Larmon Co., 2935 Spring Grove Ave., Cincinnati, Ohio.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Safety Grinding Wheels: The complete line of grinding wheels made by the Safety Grinding Wheel & Machine Co., Springfield, Ohio, is described in Catalog No. 11, which is issued by this firm. The book also contains instructions for operating grinding wheels, tables of grinding wheel speeds, pulley calculations, and other information for the user of grinding wheels.

Saving Time With Small Tools: A line of time-saving small tools, including "Use-'Em-Up" drill sleeve, "Wear-ever" chucks, collets, cutters, reamers and tap holders, counterbores, spotfacers, and other tools is described in Catalog 36, issued by Scully-Jones & Co., 1909 S. Rockwell St., Chicago, Ill.

"Gold Seal" Precision Lathe: The various types and sizes of "Gold Seal" lathes that are manufactured by The Sebastian Lathe Co., 900 Culvert St., Cincinnati, Ohio, are described in detail in a catalog that is now published by the firm mentioned. The book is well illustrated with views of the lathe in operation and with cuts of the various units of the machine. Sent free upon request.

Equipment For the Shop: Vises for the bench, drill press, milling machine or shaper; angle plates; adjustable clamps, jacks and other tools for the machine shop, are described and illustrated in a booklet that is published by the Sheldon Machine Co., 3253-55 Cottage Grove Ave., Chicago, Ill. Copy free upon request.

Rapid Drill Jigs: How time can be saved and drilling operations made easier by the use of a quick-acting drill jig is told in a booklet that is issued free by the Siewek Tool & Die Co., 10230 Woodward Ave., Detroit, Michigan.

"Chucks and Their Uses" is the name of a book which contains a full description of the different kinds of chucks and suggestions for the proper care of chucks, and tells how chucks should be fitted to lathes. It also contains a number of suggestions for general shop practice. Sent free upon application by The Skinner Chuck Co., New Britain, Conn.

Shaping With Modern Equipment: The Smith & Milt-Company, 2889-91 Spring Grove Avenue, Cincinnati, Ohio, has issued a booklet which describes and illustrates the line of modern shaping equipment made by this firm. Copy free upon request.

Electric Drilling and Grinding Equipment: A book that is issued by The Standard Electric Tool Co., 1938 West Eighth St., Cincinnati, Ohio, tells how time can be saved, better work done, and the efficiency of the shop improved by the use of electrically-driven drilling and grinding equipment. Free upon request.

Engineering and Manufacturing Service: A complete engineering and manufacturing service for manufacturers who are not equipped to handle all of their own designing, experimental, or production work is described, with illustrations of the equipment available, in a bulletin that is issued by The Steel Products Engineering Co., Springfield, Ohio.

Cutting and Grinding Facts: A discussion of cutting oils and lubricants, together with descriptions and illustrations of various kinds of jobs upon which cutting oils are used, is contained in a booklet that is issued by the Sun Oil Company, Finance Building, Pittsburgh, Pa. Free upon request.

Rigidmilling Principles and Practice: A book that shows how the Rigidmil can be adapted to various kinds of usual and unusual milling operations, and which describes in detail the work that can be handled by this machine has been issued by the Sundstrand Machine Tool Co., Rockford, Ill. Copy free upon request.

Save Cutting Oil: How cutting oil can be separated from chips and thus reclaimed by the use of a centrifugal chip "wringer," is told in a bulletin that is issued free by the Tolhurst Machine Works, Troy, N. Y.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

Multiple Drilling With a Single-Spindle Drill: Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 24, which has been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.



The DESMOND-HEX

*The Most Durable Type of
Mechanical Dresser Made*

The Hexagonal, hardened steel nuts inserted in the jaws of the Dresser have six

holes, each of which in turn, becomes a bearing for the spindle carrying the cutters.

WRITE FOR CATALOGUE M

The DESMOND-STEPHAN MFG. CO., URBANA, OHIO

BROACH for Accuracy—Economy!



Let us show
you how to finish
more holes
—more accurately—
and
at less cost.

The American 2-Ton Hydraulic Press

is recommended
for broaching connecting
rods and work that comes
within the 2-ton
range. We manufacture
presses from 2 tons to
150 tons pressure,
also all types of
broaching tools.

AMERICAN BROACH & MACHINE CO.
ANN ARBOR, MICHIGAN

LUFKIN

"RAPID READING" MICROMETERS

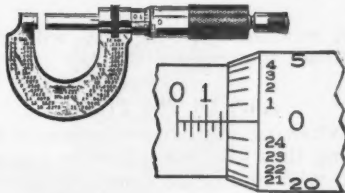
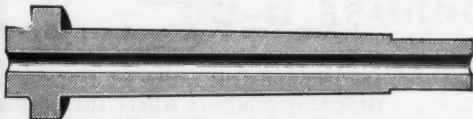


Illustration shows new method of
marking the sleeve; every thousandth
numbered. It makes reading
quicker, easier, and more positive.

Ask your tool dealer to see them
Send for Catalog No. 3

THE LUFKIN RULE CO.
SAGINAW, MICH.

Hollow Bored Forgings for Piston Rods, Rams, Clutch Shafts, Steel Pipe, Lathe Spindles, Hydraulic Cylinders, Etc.



Accurately made, fairly priced,
speedily delivered—to your
specifications.

May we quote?

AMERICAN HOLLOW BORING COMPANY, 1035 W. 19th St., Erie, Pa.



Riff=Raff Ravings

By GEO. ALEXANDER MANN
Raver-in-Chief

Girls—Answer Doc That

"Oh where," said the doctor,
"I would like to know,
Can I 'vaxinate' yuh,
Where it doesn't show?"

A mountain of difficulty will be a
molehill tomorrow.

Ain't Ut Tha Troof?

When we see a beautiful friend frau
going thru life with a homely sap of a
hub who looks like somethin' the big
game hunters dragged in, it makes us
feel that she musta got him in one o'
those blindfold tests.

Speakin' o' Fliv expense—the up-
keep's got nothin' on the turnover.

Tight Is Right

Of all the close birds,
No worse on the dockets,
He's one o' those guys
With the one-way pockets.

Intentions are valueless—the world
judges you by your actions.

Depends

"B'lieve in pettin' parties?"
He asked of Lizzie Carr;
She said, "Well, it all depends
On who the parties are."

Modern legal measures—quarts and
pints.

One reason why the youngsters o'
the present day are so restless—it's
hard to get to sleep after a heavy
breakfast.

A Flashy Return

"No girl's made a fool
O' me," said Hen;
"Well," said Myrtle,
"Who was it, then?"

Those who do nothing usually love
nothing and achieve nothing.

Overcome objections with a smile.

Bright Boy—Sammy

Maw, I got a hundred—
The class I'm a-leadin'—
Got 60 in spellin'
An' 40 in readin'.

Courage plus wisdom makes riches.

Willie says "An honest confession
may be good for the soul, but it's dem
tough on the seat o' the trousers."

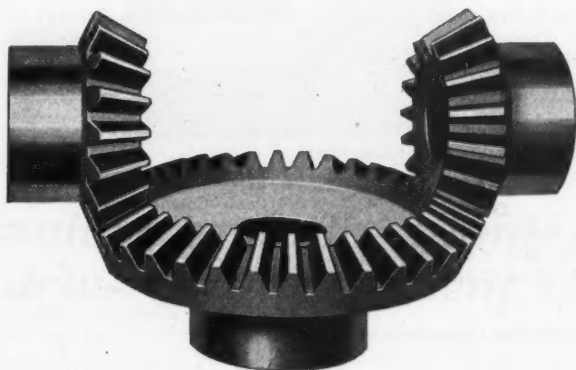
Business is always as good as you
are.

I Ask You P. A.'s—Am I Right?

The more we see o' derby hats on
sales-hounds the more we feel that on
slide-trombones is where they belong.

Aimin' high means nothin' if you're
a rotten shot.

Our bevel gears
are generated
theoretically
correct.



THE CINCINNATI GEAR CO.

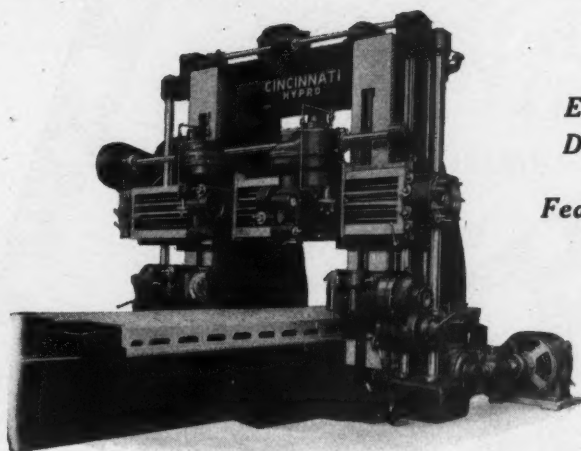
1825-41 READING ROAD

CINCINNATI, OHIO

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NEW CINCINNATI HYPRO PLANER MILLER



*Every
Detail
a
Feature!*

Frictionless and vibrationless drive through Silent Chains

Both the vertical feeds and the two transverse milling heads of this new Cincinnati Hypro Planer Type Miller are efficiently operated through Silent Chain drives.

This patented silent chain insures a smooth flow of power to the cutting tools at all speeds.

Ask Hypro Engineers to detail this and the many other features of the Hypro Planer Type Miller.

Other features of the Hypro Planer Type Miller:

Complete Electrical Control.
Independent Rapid Traverse to All Heads.
Independent Power Feed to All Heads, Rail and Table.
75 Feed and Spindle Speeds.

THE CINCINNATI PLANER CO.

3100 SOUTH STREET

CINCINNATI, OHIO

Some LIGHT on HOLE PERFORMANCE of CLEVELAND TWIST DRILLS and REAMERS

FOR the past five years a large manufacturer of oil well equipment has confined his reaming operations to one type of reamer.
Other reamers, from time to time, have been tested, found wanting, and discarded. The best reamer tried succeeded in doing about one-half the work of

PEERLESS HIGH SPEED REAMERS

TRADE MARK REG. U.S. PAT. OFF.

In this plant, not merely have Peerless Reamers actually demonstrated a 2 to 1 superiority—
Not merely have they reduced reaming cost by 50%—

But, because of their consistent uniformity, they can be depended upon to produce consistently holes form, smooth and accurate life.

These are the features of Peerless High Speed Reamers that we want to impress: (1) They are accurate; (2) They are remarkably uniform in quality and reaming capacity; (3) They leave a record for long life. (4) And they ARE economical.

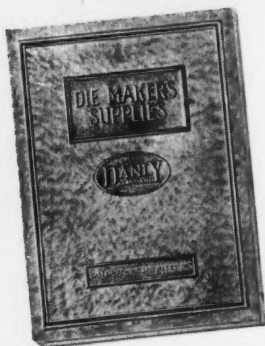
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Complete details of the performance of Peerless High Speed Reamers, briefly referred to above, have been reprinted in Digest No. 64, which you will find interesting. Shall we send you a copy?

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CLEVELAND
MAKING DRILLS, REAMERS, AND TOOL BITS SINCE 1889
SAN FRANCISCO

6-Famous Tools





This is the standard reference book among some 14,500 designers, tool room superintendents, die makers, purchasing agents. No executive responsible for tooling up or manufacture of stampings and pressed metal parts should be without this book. Send for it, right away.

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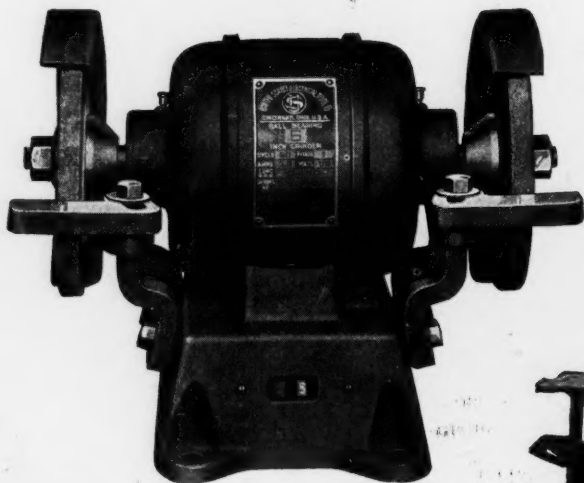
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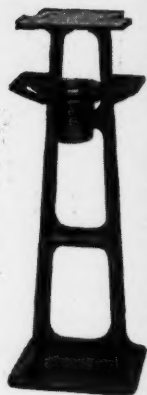
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Easily converts bench grinder into pedestal grinder.

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